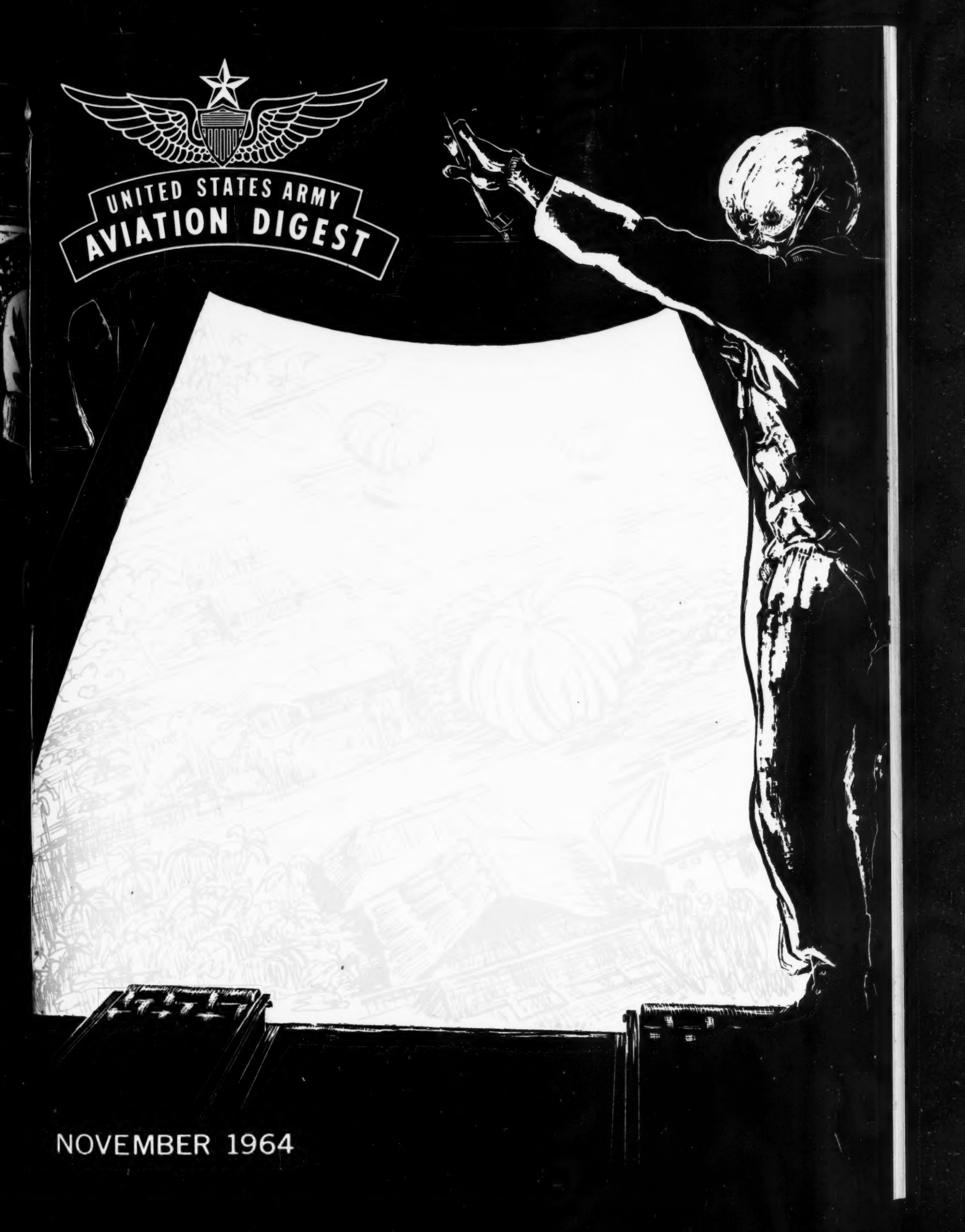

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CONTENTS

The Army's Tactical Mobility Concept, Brig Gen George B. Pickett, Jr. 1

C. O. D. — Cargo on Demand, Capt Thomas H. Harvey 6

Can Safety Be Overemphasized?, Capt Clark L. Carmichael 11

The Flying Crane, Richard K. Tierney 12

Why Maintenance Training for Aviators?, Capt Robert H. Jennings 16

You Buy 'Em . . . We Fly 'Em, Capt Howard L. Setzer, Jr. 19

Time It Right and Save the Flight, CWO-2 Clarence J. Carter 25

Standardized Helicopter Stick Grips, Maj Fred W. Leuppert 27

Survival Flaps, Maj Dale E. Hucke 32

Crash Sense, Maj Chester Goolrick 33

An Airfield on Ice, Maj J. W. Reser 47

And the Bird Dog Limped Home, Lt James W. Case Inside Back

. . . to fly again Back Cover

The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

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The Army's Tactical Mobility Concept

Brigadier General George B. Pickett, Jr., USA

THE SUPREMACY of the human factor is a lesson learned in war and too often forgotten amidst the technological advances of peace. Just two years after the Second World War, General S. L. A. Marshall wrote:

> We have come through another great war, and its reality is already cloaked in the mists of peace. In the course of that war we learned that man is supreme, that it is the soldier who fights, who wins battles, that fighting means using a weapon, and that it is the heart of man which controls its use . . . . That lesson we are already on the point of forgetting. We can ill afford it.

These words are as timely today as when they were written 17 years ago — perhaps even more timely. For without the human element in the equipment of today or the weapons systems of tomorrow, the combat potential of the Army will be severely hampered — if not completely forestalled.

Gen Pickett is Chief of Staff, U. S. Army Combat Developments Command.

Flexible battlefield loads are shown here. Left: Chinook lifts M56 Scorpion 90mm self-propelled antitank gun weighing 14,100 lbs. Right: 155mm howitzer weighing 12,500 lbs is airlifted for deployment by troops. The CH-47A can carry 32 combat ready troops, or 24 litter patients.

As we examine the more detailed and scientific aspects of human factors in Army tactical mobility, I urge you to keep uppermost in your mind the man-machine combination and the requirement for their complete compatibility.

I would like to discuss briefly the Army's tactical mobility concepts, with special reference to the Army's airmobility concept.

This concept, which may constitute the most striking advance in Army tactical mobility since World War II, has three primary objectives which both complement and supplement each other:

• The first is to restore balance between firepower and the other essential functions of mobility, intelligence, and control.

Since World War II, increases in firepower have outstripped advances in mobility, intelligence, and control. The Army airmobility concept involves the application of organic aerial systems, using both new equipment and new concepts, to assist in this restoration of balance.

• Battlefield mobility, the second objective is a vital requirement of today's Army. Its necessity is dramatically illustrated by the following data on the ratio of men to land mass in a typical corps area.

In the Civil War, there was an average of one man for about every 800 square yards. In World War I, this ratio jumped to one man for approximately 5,600 square yards. In Vietnam, where there is no "front" nor "rear," the average is about one man per 460,000 square yards.

The Army's answer in part is the airmobility concept, which seeks to achieve by use of organic aerial vehicles the gains in mobility and surveillance which are required to fight on widely dispersed battlefields and to provide these mobile forces with an effective service support capability.

• The third objective of the Army airmobility concept is to provide the means for welding into an effective organization the elements of infantry, firepower, and organic airmobility.

Organic aerial vehicles are a logical evolutionary step in the development of tactical mobility in land warfare. Let me place this concept in its historical perspective.

The mainstay of the Greek army was heavy infantry organized into close-ordered phalanxes. Mobility was limited to leg-power and the phalanx gained its power by shock tactics. Alexander the Great increased the phalanx's flexibility by combining it with cavalry corps on the flanks and creating light-armored 250-man infantry units capable of independent action. With this army, he conquered the then civilized world. His successors, however, took to heavier armor, elephants, and fortifications. In the Second Century B. C., they were conquered by the Roman legions, whose greatest strength lay in their mobility, made possible by basic 100-man units capable of independent maneuver.

By the Fifth Century A. D., a new concept of mobility — the horse — became the dominant force of war. Over succeeding centuries, however, mobility again gave way to holding power characterized by the medieval armored knight and fortified castle. Ever heavier armor and ever stronger fortifications at last reduced war to a stalemate, a deadlock not broken until the 14th Century when mobile infantry organized into companies and working as independent units finally broke the power of the armored knights. At last firearms brought an end to the medieval system.

Among the great captains of more modern days who welded mobility, firepower, and men into an

effective fighting force are Gustavus Adolphus, Frederick the Great, and Napoleon Bonaparte. All of these gained their successes by employing armies that could move rapidly, maneuver readily, and achieve success by surprise.

World War I, on the other hand, provides the greatest and most tragic example of massed warfare and its catastrophic results. On the Western front, the trench stalemate continued from the fall of 1914 to the spring of 1918 despite vast increases in artillery fire. Only in the early stages was the stalemate inherent in the prevailing weapons. Thereafter it was due to doctrinal lag—the failure to appreciate that the increase in firepower had made linear tactics obsolete in offense as well as defense.

It is commonly said that the tank was the instrument of warfare that broke the stalemate. This is erroneous. What actually broke it was adoption by the Germans of new tactical methods on the Western front based on granular rather than linear formations. In defense, dispersed granules or groups of from 8 to 16 men were distributed in depth, while the major fraction of the forces were held well back for counterattack. In offense, these granules became the basic combat unit capable of independent maneuver. Following intensive bombardment, these specially trained groups moved forward, probing for weak spots in the enemy's defenses, bypassing strong points, and taking surviving enemy machinegun nests in flank or rear. These factors achieved the large-scale breakthrough in the spring and summer of 1918 commonly called the "Hindenburg Drive." I point out that the formulation of this doctrine reflected not a superiority of individual minds but a system that allowed mobility of men and ideas.

The tank as an offensive mobile weapon was known in World War I. As a weapon, it could have overcome the dominance of the machinegun. But the British failed to develop adequate doctrine for the tank, and the machinegun continued to take its tremendous toll. Again it was the Germans who evolved appropriate tank doctrine, employing it and the new concept of airmobility in the effective striking force of tank-infantry-Stuka formations known as blitzkrieg. We followed with our combined arms team of infantry, armor, and artillery. This was the concept which won World War II, if it can be said that any concept did so.

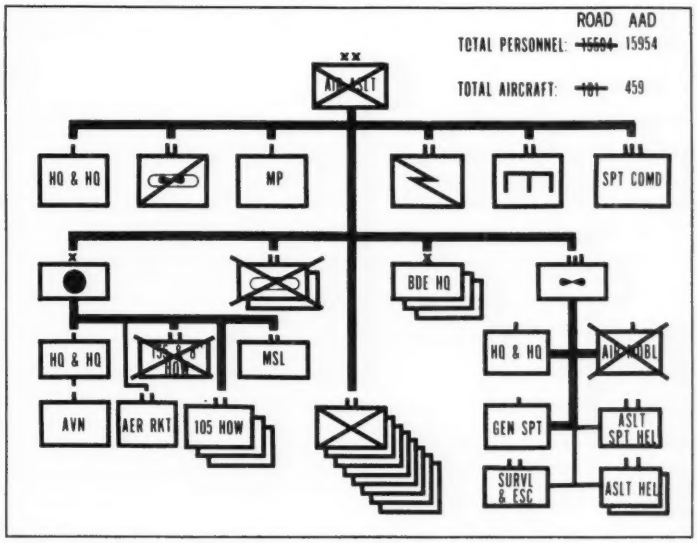
From this brief resume, I think it fair to draw three conclusions: First, progress in the tactical art has generally been in the direction of increasing flexibility. Second, victory has come when independent units, balanced in infantry, firepower, and mobility, have been employed. And third, the side which has developed effective doctrine for employment of organizations and materiel generally has a distinct advantage.

Viewed from this perspective, the Army airmobility concept is a logical development in the history of land warfare. It seeks to restore balance among the basic combat functions of intelligence, firepower, command control, communications, service support, and mobility; and to weld these into an effective organization. I believe that through the use of organic aerial vehicles and application of sound doctrine, the Army can make substantial gains toward these objectives. The concept is being evaluated.

The organizations testing this concept are the 11th Air Assault Division (Test) and its companion the 10th Air Transport Brigade (Test) at Fort Benning, Ga. These two units were established in April 1962 by the Department of the Army to review Army Aviation requirements. The board is commonly referred to as the Howze Board, after its president, Gen Hamilton H. Howze. The board recommended three basic organizations for implementation of the Army airmobility concept: the air assault division, the air transport brigade, and the air cavalry brigade.

The basic organization of the air assault division is the standard ROAD division as modified (see fig. 1). Only the heavier, less mobile units have been eliminated and either lighter or completely airmobile units such as the aerial rocket

Figure 1: Air Assault Division (T).
Crossed out units are organic to ROAD Division.



battalion substituted. The most striking change is a reduction of some 2,000 wheeled vehicles, substituting about 360 air vehicles.

The division has three brigade headquarters to which combat units are attached to form tailored task forces. There is the normal complement of division headquarters, engineer, signal, and military police headquarters.

Division artillery has the three traditional 105mm howitzer battalions, plus a battalion of helicopter-mounted aerial rockets and a LITTLE JOHN rocket battalion.

Eight air assault infantry battalions rely on division aircraft for transportation to the objective area.

The aviation group consists of a headquarters company, one surveillance and escort battalion, one assault support helicopter battalion, and two assault helicopter battalions. This group contains all the airlift and surveillance aircraft of the division.

The air cavalry squadron consists of three air cavalry troops and a ground cavalry troop. The squadron has the traditional cavalry missions of reconnaissance, screening, security, and limited assault.

The support command is responsible for the supply and maintenance support of the division.

Now that we have a basic understanding of the division's organization, let us consider some of the most significant air vehicles used.

The OV-1 MOHAWK is capable of speeds in excess of 200 knots, or slow flights of less than 70 knots. Thirty Mohawks are located within the division's aerial surveillance and escort battalion. Twenty-four of these are armed and configured primarily for visual and photographic reconnaissance. There are also two surveillance models which carry side-looking radar and photographic and infrared equipment.

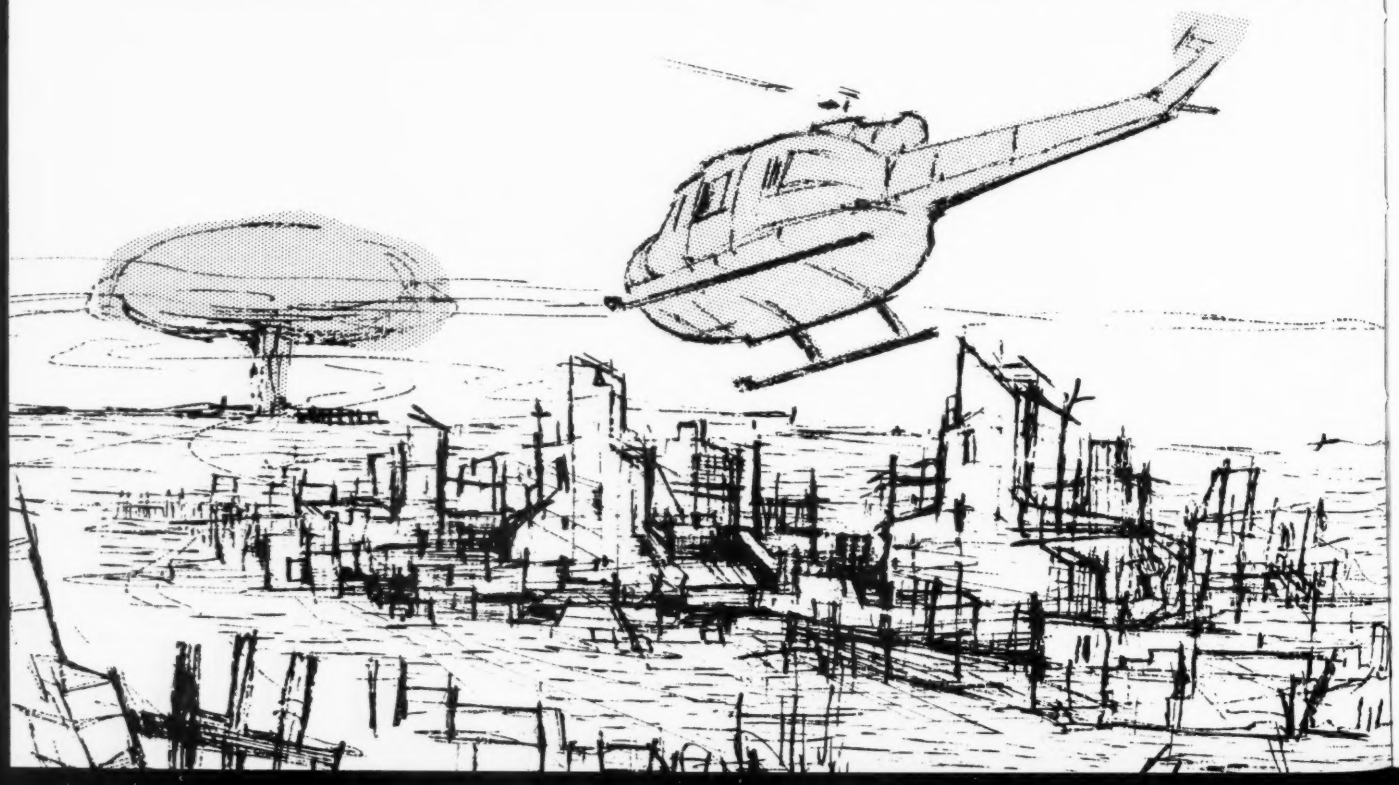
The UH-1B IROQUOIS mounts various armament, including the M-6, 7.62mm, quad machinegun system consisting of two machineguns mounted on each side of the helicopter. The system is flexibly mounted to permit maximum elevation, depression, and traversing. However, the pilot can only fire the weapon in locked or straightforward position.

One of the best systems is the 2.75-inch aerial rocket, which allows the helicopter to put a tremendous volume of fire in a given area from a respectable distance. It is particularly suited for suppressive fire during an attack. As many as 48 rockets have been mounted on the UH-1B, capable of being fired in any number of pairs or the complete load salvoed in about 4½ seconds.

A combination system, consisting of four 7.62 quad machineguns and 8 rockets mounted on each side of the UH-1B, is being evaluated.

For antitank missions, the Army has placed six SS-11 (M-22) missiles on the UH-1B. This missile can pierce the armor plate of any known tank at a range of over 3,000 meters.

Turning now to cargo helicopters, the latest assigned the division is the CH-47 CHINOOK,



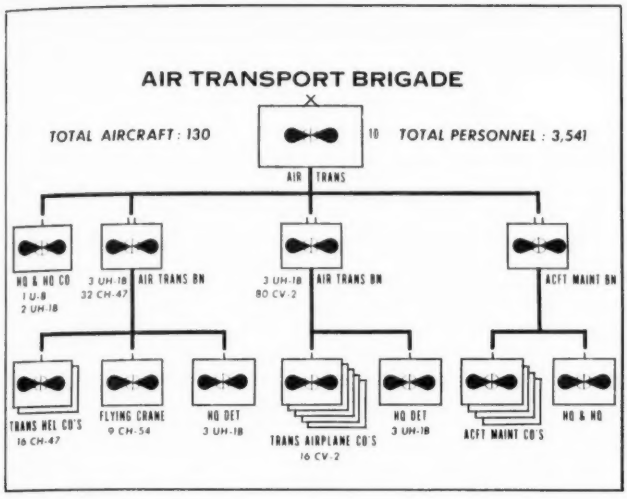


Figure 2: 10th Air Transport Brigade (T).

the newest and most modern of our medium transport-type helicopters. It is the first with rear-ramp loading, permitting it to carry field artillery pieces, trucks, and other bulky loads. This helicopter can move 32 combat-equipped troops or 24 litter patients.

The Chinook is found in the division in the assault support helicopter battalion, where there are three companies of 16 aircraft each. It is also found in the air transport brigade, where there are two companies of 16 aircraft each.

Among the potential advantages of the air assault division are its inherent advantages of increased maneuverability which may offer a combat effectiveness differential that may be decisive in counterinsurgency operations in remote, underdeveloped areas, or in exploitation phases following tactical nuclear attack. Use of air assault forces is not, however, limited to these purposes. Air assault divisions should be capable of advantageous employment in a variety of tactical situations which capitalize on rapidity of movement and the gaining of tactical surprise. Missions of this sort are: advance to contact, covering force operations, over-obstacle attack, exploitation of special weapons effect, infiltration and harassment, seizure of critical terrain, counterattack, delaying action, reconnaissance and security, reinforcement of threatened areas, exploitation and pursuit, envelopment, counterinsurgency, feint and demonstration or ruse, and constitution of a highly mobile reserve (see fig. 2).

The air transport brigade was the second basic type of organization recommended by the Howze Board. Its organization is shown in figure 2. The air transport brigade can be employed in two basic roles. The first may be termed its normal employment — to provide an air line of communications to a normal corps or to an advanced portion of a corps in special situations. (For example, if General Patton had had air transport brigade support in the Third Army's race to the Siegfried line in 1945, he would not have had to slow down his advance for lack of supplies.) The second is to support the air assault division, operating in an unsophisticated area where there is no ground line of communications.

In addition to one U-8, the only aircraft in the air transport brigades not in the division is the Caribou.

The Army procured the CV-2 Caribou to team with helicopters of equivalent payload for the mission of troop transport and battlefield resupply. The Caribou is an extremely rugged shortfield aircraft. It will carry three tons of materiel or 32 troops. Like the Chinook it has rear-ramp loading, making it capable of handling large and difficult objects.

Potential advantages of the Army airmobility concept are: extended tactical range, swift response, reduction in time immediate commitment of forces, breaching of obstacles, advantageous tactical position of forces, small unit integrity, multiple directions of attack, ability to bypass strong positions, and wide choice of courses of action.

Pending the completion of our test and evaluation of the Army airmobility concept, no firm position has been established whether the air assault division and air transport brigade will be incorporated into the Army force structure. A decision will be made at an appropriate time when all tests have been evaluated.

In summary, the Army's airmobility concept with its organic aerial vehicles is a logical evolutionary step in the development of tactical mobility in land war. We look to you for assistance in helping to weld the man-machine combination into an effective whole. Without the human factor, our technology will, indeed, be sterile. For, as General Hans von Seeckt, the first commander in chief of the German Army after World War I, said: "Material has prevailed over human masses but not over *man* and never will, because it only becomes animate in the hand of man . . . . Material is superior to the living mortal human mass, but it is not superior to the living and immortal human mind."

Here's how one unit increased the use of the CV-2B aircraft in the counterinsurgency situation in the Republic of Vietnam.

C.O.D.

CARGO ON DEMAND

Captain Thomas H. Harvey

ON A JUTTING hilltop some 1,000 feet below us were two small, orange panels which marked the drop zone of the Vietnamese special forces patrol. To the newly arrived CARIBOU pilot it seemed that this was hardly an adequate target for his bulky load waiting to be air-dropped. The DZ was located on a small hilltop, surrounded on three sides by steep mountains which caused tricky wind currents, and it was all but obscured by the prevalent monsoonal clouds.

Only through luck and the gifted directions of the patrol leader was the pilot able to find the drop zone. And now the mission had to be carried out, for the patrol desperately needed the rations and supplies aboard. This was not a training mission where failure meant an unsatisfactory report. Failure here could cost lives.

It was going to be tricky, and if the bundles missed the DZ they would be grabbed up by the Viet Cong or lost in the jungle. The grass was 10 or 12 feet high; hence, many DZs were on ridges or mountaintops. A miss of a few feet could mean

a 1,000- or 2,000-foot drop to the valley below, and in thick jungle this could take days to recover. The school solution would not fill the need here. This required a special technique. This article is intended to explain the delivery technique developed by the pilots of the aviation unit.

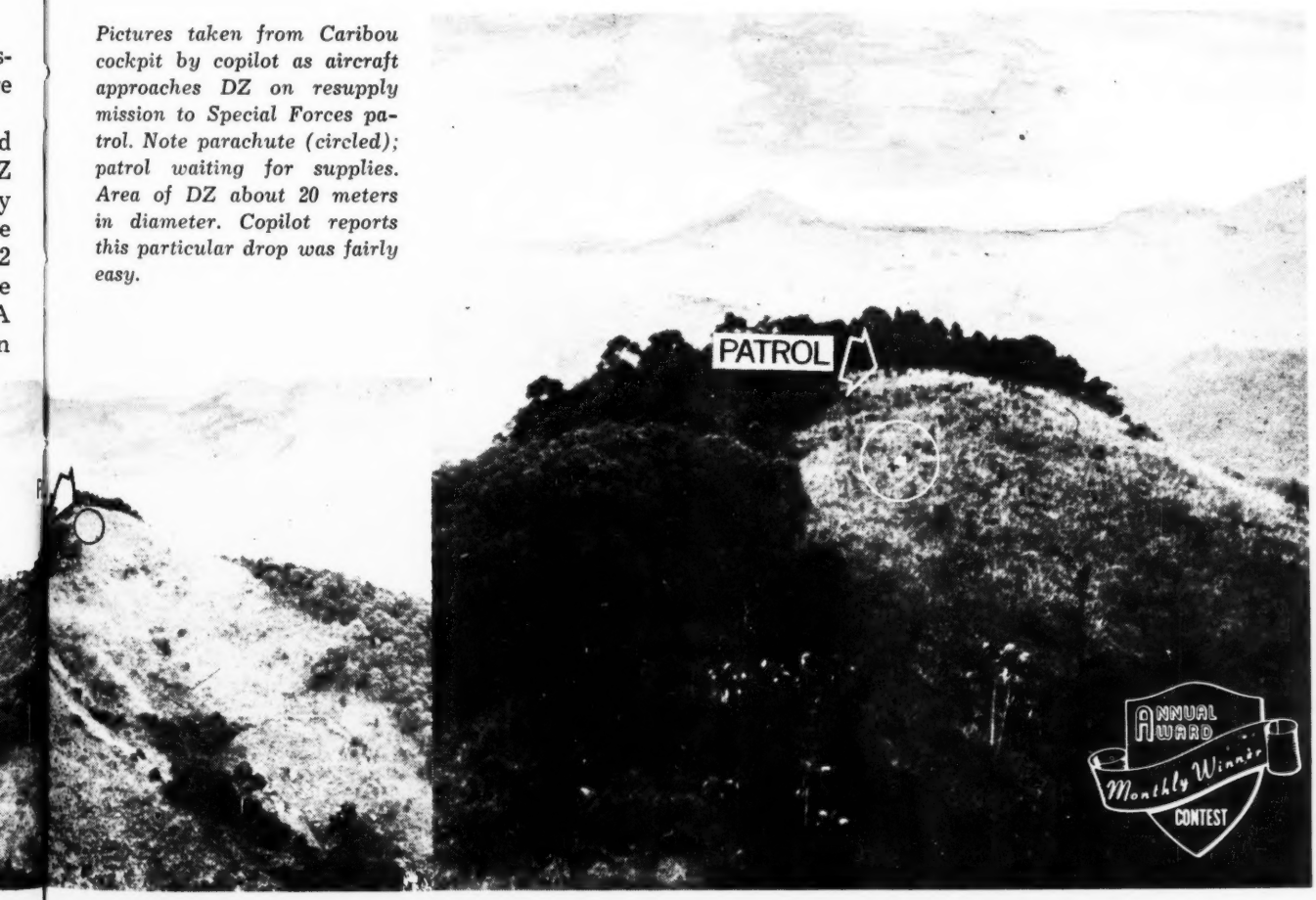
The only apparent approach was to fly directly at one of the mountains, and when the aircraft was alongside the DZ, turn and dive toward the panels, as if one would cascade down a hillside. At the bottom of the dive a pullup was executed and the bundles were released over the target. The exultant "Beautiful drop!" heard by the crew was acknowledgement that the mission had been accomplished with success.

Although the mission was performed under poor weather conditions and the DZ was of postage stamp size, it was not untypical of the resupply missions by Caribous for special forces personnel in the mountainous areas of the Republic of Vietnam. The nature of these drop zones, small and isolated, demands a different technique of aerial delivery from that currently taught in CONUS.

This new approach to the aerial delivery problem began in an almost chaotic fashion at Fort Bragg with the 22d Special Warfare Aviation Detachment. The aviation detachment itself was a new concept in counter-insurgency operations, and many heretofore unheard of ideas were to be experimented with. Resupply by aerial delivery to the special forces team was a natural, as this is the only means in many areas of Vietnam.

The first trials were conducted on enormous drop zones and were quite successful. However, it was obvious to all concerned that the convenience of this size DZ would not always be at hand. So, the next area of application was a much smaller DZ in the middle of main post. Unfortunately, the first bundle landed on a car in the middle of Reilly Road, an adjacent thoroughfare. But this calamity did not deter the experiment, and no more incidents of this nature occurred.

Although we were certain that considerable aerial delivery was



Pictures taken from Caribou cockpit by copilot as aircraft approaches DZ on resupply mission to Special Forces patrol. Note parachute (circled); patrol waiting for supplies. Area of DZ about 20 meters in diameter. Copilot reports this particular drop was fairly easy.

C.

A. Approach to DZ as seen from cockpit of CV-2. Notice fog partially obscuring row of houses. Mountain ranges 3,500 - 6,000 feet obscured by fog bracket DZ on three sides. B. Note mountain range obscured by fog. Aircraft approaches DZ (circled). Photos B. C taken by Special Forces ground troops. C. Bundle dropped by aircraft. DZ in circle.

B.

A.

being conducted in Vietnam and elsewhere in the world, we felt sure that this particular technique was not being employed, as later proved to be true. For us it was a vehicle for demonstration purposes, but its need and applicability proved to be of the highest order in Vietnam, especially in the mountainous regions.

The delivery of hundreds of tons of food and equipment by a fleet of helicopters or large convoys is both uneconomical and impractical, and in some instances the use of convoys is impossible. Consequently, accurate aerial delivery was the answer. Accurate is the key word, for only small drop zones are available and a miss is usually a loss.

Whereas most drop zones are 75 to 100 meters long, occasional resupply missions necessitate hitting DZs only 20 meters wide surrounded by 50-foot trees. Testimony by a patrol leader whose men have been without rations or ammunition for two or three days will verify that airdrops under these conditions *have* to be on the money.

The following is a brief description of one of our aerial deliveries:

Approximately 6 minutes before the anticipated drop time the red warning light is switched on. Upon this signal the crewchief and the dropmaster release the tiedown straps on the first pallet which is to be dropped on that particular pass. (The remainder of the palletized loads are left securely tied down.)

The load is then rolled to the tailgate of the aircraft, which is in a horizontal position, and it is restrained by a safety release strap operated by the dropmas-

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Capt Harvey is attending the AOCC at Fort Sill, Okla.

ter. At this time the crewchief secures the static lines, which have all been previously hooked to a common D ring, to a tiedown ring on the floor of the aircraft (prevents the static line from striking the tail cone of the aircraft). Then a verbal signal is given to the pilot over the intercom system that the load is prepared for drop. It should be pointed out that this is done only when the aircraft is in level flight attitude.

Simultaneously with the above procedures, the pilot and copilot go through a modified preland-ing check, excluding only the landing gear portion and boosting the propellers to either a normal climb or METO setting, depending on the terrain and the desired angle of climb after the drop. The METO setting is not an absolute necessity, but in mountainous terrain it affords the crew a safety factor and offers a tremendous psychological assurance. Upon receiving the "all ready" signal from the crewchief, the pilot continues to a point which allows him to maneuver in. Then he executes a descending turn back toward the DZ which culminates at the desired altitude in a direct flight line with the DZ.

The desired altitude is 25 to 50 feet above ground level or treetop level. In many cases the location of drop zones in mountainous regions precludes a level flight approach, and a moderate dive must be executed to spot the DZ and accurately choose a release point. In the level approach the speed is maintained at a normal cruise speed or slightly less. At approximately 50 yards before the DZ the pilot commences a climb with the application of power, and after the lapse of two seconds he switches the warning light to green.

It should be pointed out here that much depends on the crewchief and dropmaster. A slight delay by either or slowness in lift action could cause a miss. Both are secured to the aircraft by tiedowns and can advance to the edge of the ramp door. The dropmaster usually puts one foot on the load and holds onto the safety restraining strap with one arm and his own tiedown with the other. The crewchief places both hands on the load and is bent over in a pushing position. At this time the dropmaster releases the safety restraining straps and the crewchief pushes the load out of the aircraft. The pilot maintains his climbout, and the process is repeated. The crewchief runs to the end of his strap and is stopped by it a few inches from the rearward edge of the ramp door.

It has been concluded that this technique offers an optimum altitude and speed for proper deployment of G-1A type parachutes. A higher altitude of about 150 feet for the approach must be used when G-13 type parachutes are used.

The method described varies considerably from what is normally considered the standard procedure, and will prove to be what is preferred by the pathfinder trained personnel, i.e., no steering commands or execution by the ground party. The paramount consideration for aerial deliveries of supplies to small DZs in a tactical zone is consistent accuracy for recovery purposes and the reliability of "first round hits."

For tactical necessity and economy, convenience to the ground party, and accomplishment of the mission, there is no room for errors. The low altitude and relatively high-speed approach offers the pilot better protection against ground fire. It allows him to more accurately determine a release point; it precludes excessive float time of the deployed parachutes, and virtually negates the wind affect. At such a low altitude and fast approach the pilot can determine a release point better than can relatively inexperienced ground personnel. It is satisfactory for the ground party to mark the drop zone properly and provide a DZ secure signal.

While this method offers a proved method of delivery to small and seemingly inaccessible DZs, it also has its drawbacks. The most important is exposure to ground fire. Since the aircraft usually drops one bundle at a time to small DZs, it makes many passes. In most of the jungle areas there would be only one approach. High speed and low level offers a measure of protection.

An important point for morale and peace of mind of safety officers across the world: ample safety precautions are taken for crew members in the rear of the aircraft to preclude their falling from the cargo compartment.

All relatively new ideas, especially those that diverge from the established pattern, normally meet with some controversy, and perhaps rightly so. Although our methods do not conform to the refinements employed in high altitude drops in conjunction with pathfinder teams, it is consistent with the basic operational and safety procedures. Moreover, in the final analysis, our method has proved to be more satisfactory for the supported agency than have other techniques employed in this particular theatre of operations.

Captain Harvey has sent us additional comments comparing the delivery system he used in Vietnam with the LOLEX system. For

different size loads, the two systems appear to complement each other.

I have just read the article on the LOLEX delivery system in your June edition. I was quite impressed with the technique, and I was further impressed after witnessing a demonstration here at Fort Sill.

I feel very strongly about the considerations of aerial delivery, especially in a situation as typified by the action in Vietnam. My entire year, or almost all of it, was spent in resupply to Special Forces units and Vietnamese units. The problems encountered were significantly different from what would be considered a conventional war with conventional resupply situations. I will say without qualification that 90 percent of our deliveries could not have been accomplished through employment of the LOLEX system.

The LOLEX is a magnificent technique that has a definite applicability under a given set of conditions in a conventional logistical resupply. However, its usefulness would be considerably limited in an unconventional environment.

The advantages of the LOLEX are self-evident and they were magnificently detailed in your publication; however, any discussion of some manifest disadvantages was overlooked.

The first consideration for the employment of the LOLEX would be a drop zone approximating the ideal conditions of a landing zone, particularly in respect to size, surface condition, and barriers. A second thought is that this system is practical if only heavy loads are to be dropped. I am not sure of the technical aspects, but I don't believe the extraction chute could be used in a practical sense with light loads. This leads to the problem of a load hanging up partially. Once the chute has been deployed it would be virtually impossible to abort the drop, and the load, if it finally was ejected, would miss the drop zone if it were not a very large zone.

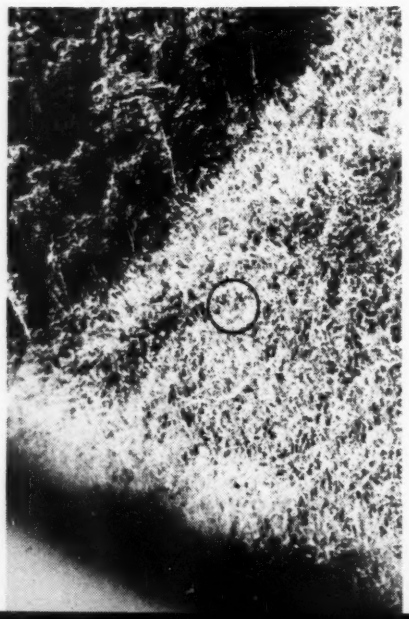
These disadvantages have little significance when you are considering a major logistical effort in a general or limited conventional war. They take on a magnitude of major proportions when you consider the problems encountered in Vietnam, or when your considerations turn toward future situations that will undoubtedly be very similar to Vietnam.

What was encountered "over there" was an extensive resupply to patrols and outposts with the concomitant nuisance of small arms fire by the Viet Cong. The technique employed, which was described in my article, afforded us extreme accuracy and did not allow the vulnerability to be excessive. (This also is in contrast with the LOLEX slow flight approach.) The drop zones, especially those used by patrols, were extremely small, and normally were surrounded both by 50-foot trees and Viet Cong. Our operations were mostly in the mountains, and "school type" approaches were never available.

A need exists for two different systems which have an applicability in different environments.

My paramount desire is to "get the word out" so that others in a similar combat environment may benefit.

Below left: Overhead look at DZ. Grass 12-14 feet high. Drop zones for Special Forces and Vietnamese patrols were extremely small and usually surrounded by tall trees, Viet Cong, and precipitous terrain. Right: Initial approach to DZ. Note ridgeline in background and sharp drop-off if bundle lands short. Pullout necessary to clear ridge.



Can Safety Be *Overemphasized*

Captain Clark L. Carmichael

LIEUTENANT Notsoproficient was making a night approach to a field strip. The strip lay east and west, was 1,300 feet long, and had 30-foot trees to the west. One-quarter mile from the east end was a powerline; a ridge paralleled the strip on the north; and the strip was lighted with a battery powered light set.

The wind was calm, visibility excellent, and Lieutenant Notsoproficient's approach was coming along nicely until, suddenly,

Continued on page 31

Capt Carmichael is an instructor with the Employment Division, Dept of Tactics, USAAVNS, Ft Rucker, Ala.

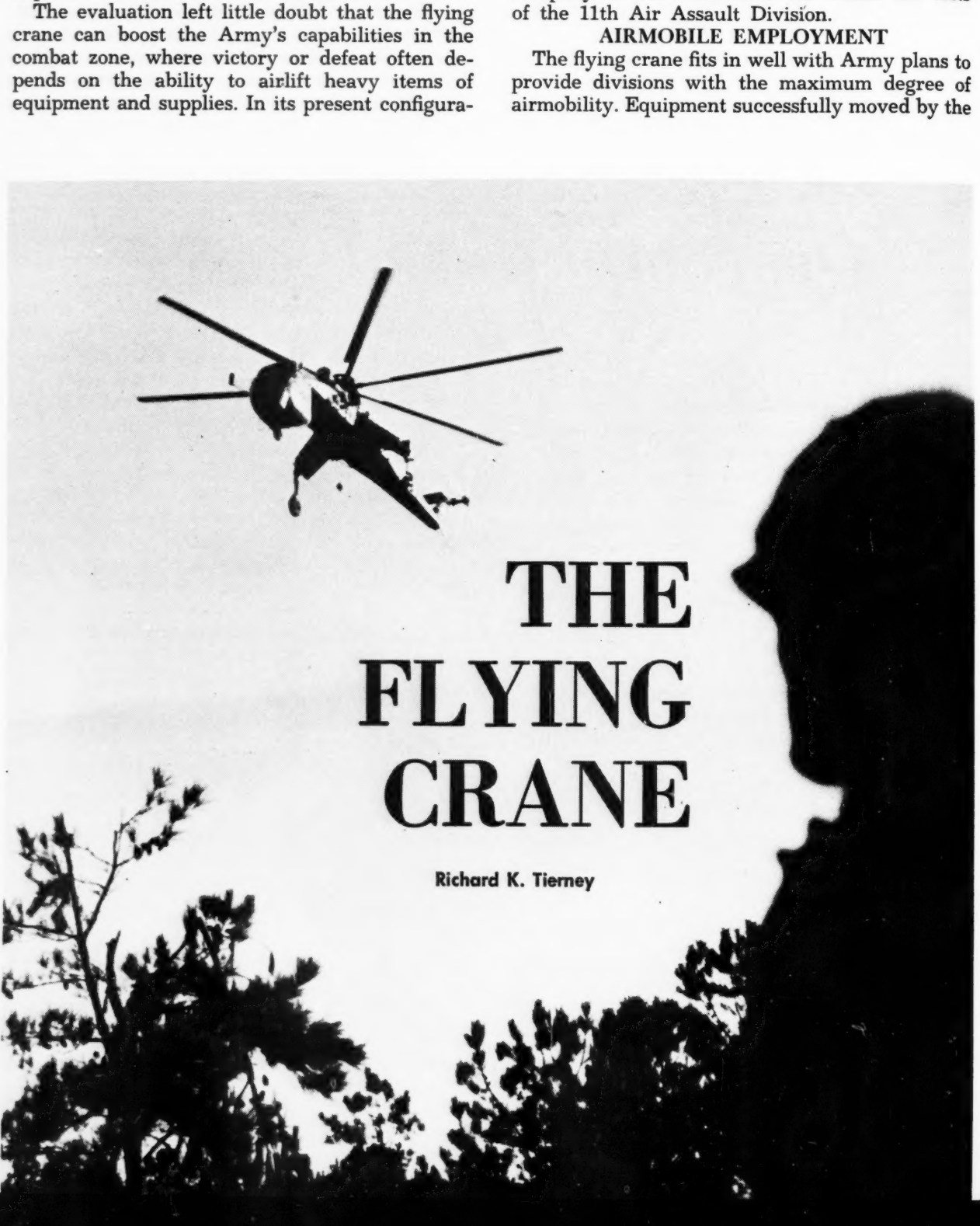
THE CH-54A flying crane recently came through an extensive Army evaluation program with flying colors. Conducted by the 10th Air Transport Brigade, 11th Air Assault Division (T), Fort Benning, Ga., the evaluation labeled Sikorsky's Sky Crane a "highly versatile load-lifter possessing excellent handling qualities and superior maintenance characteristics."

The evaluation left little doubt that the flying crane can boost the Army's capabilities in the combat zone, where victory or defeat often depends on the ability to airlift heavy items of equipment and supplies. In its present configuration the CH-54A easily fills the Army's requirements for an interim 8- to 10-ton heavy lift helicopter.

In view of the successful evaluation, the 10th Air Transport Brigade has recommended that six flying cranes (incorporating various modifications) be procured to provide a full strength company of nine CH-54As for Phase III tests of the 11th Air Assault Division.

AIRMOBILE EMPLOYMENT

The flying crane fits in well with Army plans to provide divisions with the maximum degree of airmobility. Equipment successfully moved by the



THE FLYING CRANE

Richard K. Tierney

CH-54 during evaluation includes 2½-ton vehicles, forklifts, self-propelled guns, full tracked vehicles, and the like.

The CH-34 easily transported the M-56, 90mm self-propelled gun with its three-man crew, and also airlifted the M-114 armored personnel carrier with its crew. This gives the ground commander the unprecedented capability of quickly deploying self-propelled weapons and armored vehicles by air into strategic positions ready for immediate combat.

Building bridges under possible enemy fire always has been a ticklish situation, but the flying crane can alleviate this problem to a large extent. According to the 10th Air Transport Brigade's report, M4T6 bridge sections can be completely assembled in a rear area, then flown to the bridging site. Positioning and release have proved extremely accurate.

The CH-54 also has demonstrated an ability to accomplish towing missions (such as towing barges and pulling heavy vehicles from mire) and aerial evacuation of Army aircraft. From a hovering altitude of 60 feet the crane winched up a UH-1B 40 feet and flew at airspeeds up to 60 knots.

SUSPENSION SYSTEMS

Both single- and four-point suspension systems were tried during evaluation. The single-point suspension system has the same general characteristics of winches used on nearly all other helicopters. Added features are a 20,000-pound capacity and 100 feet of cable which permit a high hovering hookup and winching of the cargo from areas dense with trees or other obstacles. However, the CH-54 had to be flown at reduced speeds because of the tendency of the load to rotate and oscillate.

The four-point suspension system provided stable load-carrying characteristics on all loads up to 17,300 pounds when the aircraft could straddle and attach the load. It also enabled the crane to pick up loads too large to straddle. The evaluation report says this was accomplished by rigging the load, hovering over it, and making hookup to the present system.

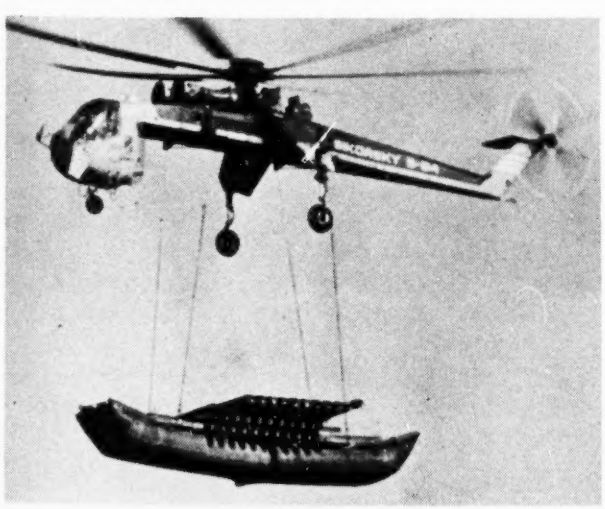
The evaluation determined that cockpit controlled winches with hook releases on each of the four points would allow hovering hookup, load leveling, and stability in flight. Winches also would add the capability of releasing loads from a hover in terrain where landing would be hazardous.

All pilots (both manufacturer's and Army) who flew the flying crane agreed that the four-point suspension system was superior to the single point. The four-point system did not allow the cargo to oscillate and permitted the aircraft to fly at 100 knots in most cases.

In each case the present four-point suspension system's limitation was the "16 inches vertical lift provided (8 inches lift by 'kneeling' gear

Right: CH-54 hauls Huey at 60 knots

Below: Bridge-building is easier with CH-54



Single- and four-point suspension systems . . .

and 8 inches on the four hydraulic struts known as 'load levelers')." The cockpit controlled winches mentioned above were offered as a solution. A recommendation already has been noted at the Sikorsky factory where winches are being designed and will be incorporated on the fifth and sixth aircraft of present contract.

The 10th Air Transport Brigade also recommended improvements on the single-point suspension system. Since cargo oscillations necessitated reduced airspeeds, it was suggested that the single suspension system be made readily removable and replaced with a quick attach device. This will allow the weight of the system (925 pounds) to be converted to additional fuel, payload or both.

The flying crane had sufficient power for vertical takeoffs under all payload conditions, including a maximum gross weight of 38,000 pounds. The aircraft's rate of climb was 2,500 feet per minute at full gross weight, and it accomplished a single engine approach terminating in a hover with a 2½-ton truck weighing 12,300 pounds as payload.

Pilot controls facing aft were used with both the single- and four-point suspension systems and afforded precise hovering over any type of load.

were evaluated during Benning tests

LOADING CONCEPTS

Both pod and pallet loading concepts were tested. The pod used with the test aircraft belonged to Sikorsky Aircraft and contained luxury-type items not needed for military use. However, the evaluation report recommended that a simplified pod be considered a basic part of each aircraft. Providing cargo and/or passenger space, the pod enables the flying crane to be used as a backup troop carrier or as a medical evacuation vehicle.

The pallet concept greatly reduces loading and unloading time. With it, the crane can quickly pick up preloaded items, deliver them, and return for additional loads without waiting for cargo compartments to be loaded. The pallet used during tests was constructed only to evaluate the concept. The 10th Air Transport Brigade report recommends that further study be made to determine optimum size and construction of a multipurpose pallet, incorporating wheels and a towing connection to facilitate ground handling. Local fabrication of pallets was considered feasible.

MAINTENANCE

Maintainability of the CH-54 during the evaluation period indicated superiority over cargo helicopters now in use. All deficiencies except engine change were corrected without special tools and overall accessibility was excellent.

Fuel servicing was accomplished with standard M-49 tankers only and required considerable

AIRCRAFT DATA

(Applies only to one of the prototype aircraft evaluated by the 10th Air Transport Brigade.)

Aircraft basic weight	19,922 lbs
Pods (complete)	3,946 lbs
Winch (central)	925 lbs
Fuel capacity	
(with auxiliary tank)	9,000 lbs
(without auxiliary tank)	6,000 lbs
Fuel consumption (2 engines operating)	3,200 - 3,500 lbs per hour*
(1 engine operating)	2,200 lbs per hour
Payload	
(with auxiliary fuel tank)	8,800 lbs
Airspeed	0-120 kt

*Tests revealed this particular CH-54 consumed 3,250 lbs of fuel per hour. (Further development of the engine is expected to reduce the fuel consumption.) On cross-country flights the CH-54 can be flown on one engine with no speed penalty.

time. Pressurized refueling facilities on the aircraft were not used since ground equipment was not available.

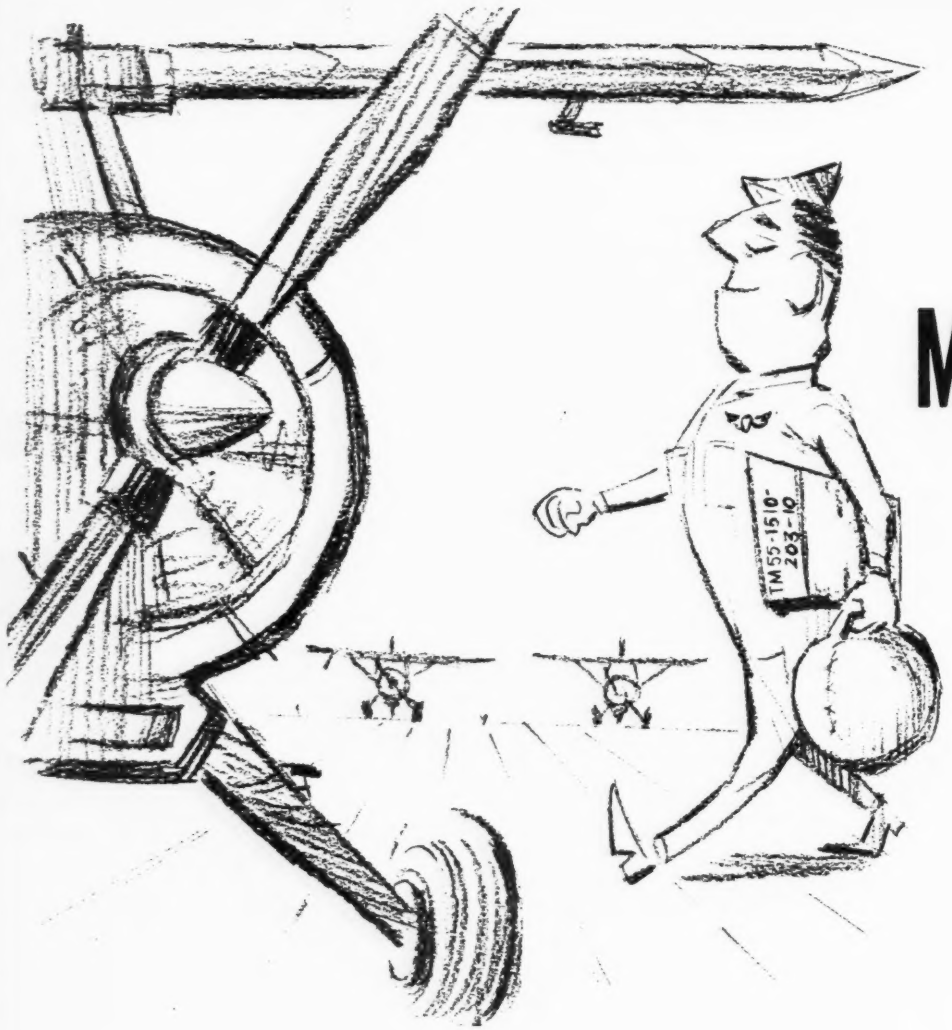
While in the field an engine was changed with little difficulty. Either a truck-mounted crane or M-62 wrecker can be used. The M-62 is preferred because of its retractable boom feature. It was noted that no means was provided for removing the rotor head or transmission during the test.

While the flying crane is slated for further evaluation to determine its full potential, it is already apparent that it offers the Army a "big lift."

Above: Self-propelled guns as well as other tracked vehicles and loads weighing up to 10 tons are within the capability of the flying crane.

Right: Big load capability (this one is 12,300 lbs) will give Army commanders a big lift toward mission accomplishments.

Dubbed "Skycrane" by Sikorsky, the CH-54A in transport van configuration can be used as backup troop carrier. Repair shops, command posts, and hospital units may also be carried in the detachable vans beneath Skycrane's unique open fuselage.



Why Maintenance Training For Aviators?

Captain Robert H. Jennings

AN OLD AND ever recurring question! It is probably asked by every student aviator who attends flight school, be he the young fledgling working toward his wings or the old, experienced ace attending a school checkout in a new aircraft.

To those who present this instruction, answering the question is easy. The big problem is selling the answer. As teachers, our desire to provide impetus in the molding of the Army Aviator and his crewchief is great. Too often, overcome with this desire, we tend to overlook the prime prerequisite for the best training possible: a properly motivated student. Therein lies the answer to your question and to our problem.

The most immediately recognizable obstacle is a curious one. It is one word: MAINTENANCE. Just mention this word in most circles, excluding those containing maintenance people, and watch the expressions on faces. Repulsion, consternation, dejection — why? It can only be attributed to one cause, lack of understanding. Deny it? Naturally!

Everyone is aware of maintenance. An aircraft cannot con-

Capt Jennings is now serving in the Republic of Vietnam.

tinue to fly without it. We have specially trained people to perform maintenance. So why must we be so cognizant of it? Why spend all that time in school studying it, when what we really need is to be in the aircraft flying? Let those specially trained people take care of it; that's their reason for existence.

Let's digress for a moment, back to what I said earlier about our desire to provide you with the best training possible. As a part of this training we strive to ensure your capability to stand out among fliers — to be more than just a pilot, more than a throttle jockey, more than a white silk scarf and sunglasses. Our goal is to make you an *aviator,* a technician, capable not only of flying the aircraft but of fully understanding the operation of that bird.

To do this the Army Aviator must be trained to accomplish a multitude of tasks. He must be able to perform the required tests and checks on his aircraft to ensure airworthiness. He must be capable of recognizing symptoms of impending malfunctions. He must be capable of analysing a malfunction, whether it occurs in the air or on the ground. He must know what is happening, why it is happening, and what he can do toward correcting or preventing the malfunction. He must be able to calculate the effect the malfunction will have on his aircraft. He must constantly consider personnel safety in his analysis, and he must strive to prevent needless loss or damage to the aircraft or other government property.

Quite a requirement. You bet your pearl-handled, fur-lined, double-clutching approach plate holder it is! You can only fully appreciate the consequences and satisfaction to be derived from this capability when you face an emergency situation.

In addition to the aforementioned reasons for maintenance training, we can list several more. Among these is the fact that not only are we aviators we are leaders, commanders, supervisors and advisors. No command attribute is more meaningful to enlisted maintenance personnel than to know that the boss recognizes their problems, can discuss the technical aspects of their job, and can intelligently describe orally, or in writing in the fault column of DA Form 2408-14, what is wrong with the aircraft he has just flown.

Another (heaven forbid?), the commander may put his finger in your eye and expound, "Son, you're to be my maintenance officer! Don't worry about MOS 4823; we'll get you to school in a few months." Farfetched? Not likely! End of the world? Not quite! A recent survey indicates approximately 15 percent of a graduating class of aviators got handed this goody on their initial assignment. No figures for subsequent assignments are available, but be sure the percentage increases rather than decreases.

We normally don't like to spread the word too far on a good thing, but if you've been in this position, and were properly prepared, you undoubtedly found it to be one of the most gratifying, interesting, and informative assignments you've ever had.

The last reason I'd like to offer is based on a contingency. We must furnish you with enough information on the systems and components of your aircraft that in the case of emergency you can perform minor repair on your aircraft. This is not an impossible assumption. Just such a case may arise. It happened in World War II; it happened in Korea; it is happening in Vietnam.

Think not? Consider this situation. A chopper flight over enemy infested territory, no crewchief aboard, a stray bullet through the engine compartment, and immediate erratic

response from power controls. Down on collective, split the needles, and with luck you're sitting on the ground, miles from any assistance other than another aircraft circling overhead. The pilot of the circling aircraft reports enemy ground parties approaching your position from all quadrants.

What can you do? Destroy the aircraft, take off on foot, and hope to be picked up later by friendly forces? Yes, you can do this, but providing you know the aircraft and its systems, you can survey the damage and determine what is needed to make the aircraft flyable again. Using your technical judgment, you can determine your capability to make emergency repairs and fly the aircraft to the nearest friendly troop concentration, airfield, or maintenance support.

The important point is that you cannot attempt repair if you are not familiar with the affected system. To do so is possibly as dangerous as walking into an enemy patrol. But if you know what you are doing and can perform a minor repair and get yourself, your passengers, and aircraft out of this predicament, you will have justified all our efforts and time spent in the classrooms for a long time to come.

Can any Army Aviator positively tell himself he does not need the capabilities we've discussed? I'd venture to say he cannot. Can an aviator acquire this capability in any way other than study? He cannot. This leads to our purpose, to our justification, and to the answer to your question. There is no better method of attaining these necessary qualifications and capabilities than under the careful guidance of the finest of instructors in the classrooms and shops of the Aviation School.

Colloquialism

DID YOU EVER consider the magnitude of the language problem our Military Assistance Program (MAP) students and foreign pilots are faced with? The following is one student's explanation of his problem:

"I arrived in your country and reported to Lackland AFB to learn your language. I learned that SAC means a place to rest, and yet you use the same term for Strategic Air Command and San Antonio College. I'm sure that these are no places of rest. Also, I learned that the word MESS means a number of persons who sit down to eat together, especially servicemen. It also means a state of dirt or confusion.

"When I was assigned to a flying organization to receive flight training, I was instructed to read and learn the Dash-One. The book makes reference to moving the throttle to the idle position after starting; use number one needle for homing to a station when using the automatic direction finding equipment; lowering the gear and speed brakes, the bomb or tanks release button; on final approach and passing over the field boundary reduce power to idle and don't porpoise or force the aircraft onto the runway with excessive speed.

"Yet, when I flew with my instructor, he used all sorts of strange terms such as — 'bring the throttle around the horn'; 'watch the Bird Dog'; 'drop the gear'; 'drop the flaps'; 'drop the boards'; 'don't hit the panic button'; 'bring it over the fence and don't pogo or spike it.'

"My instructor was a bit irritated because I lacked the understanding of the procedures. It's all in the Dash-One, except the colloquialism.

"Now I understand, but do the instructors understand our problem?"

Another example is when the IP took his newly assigned students out to the flight line during one of our warm, sunny days here in Laredo to point out an airplane and explain its various components. As they approached one, they saw an egress man removing a seat. The IP remarked, "I want all of you to observe this CAT'S operation. See how careful he performs this mission, ensuring the seat is COOL, thus eliminating a TRIP TO THE MOON."

After they departed the aircraft the IP asked if there were any questions. One MAP student remarked, "I saw no cats, the seat felt warm to me, and how could that man get to the moon?"

SELECT YOUR CHOICE OF WORDS CAREFULLY.

Laredo AFB
"Flying Safety Brief"
Reprinted from *Flying Safety Officers' Study Kit*,
Feb-Mar 64.

Captain Howard L. Setzer, Jr.

Captain Setzer discusses in chronological sequence the development of a training program from initial concept to final implementation. He outlines the major actions which must be accomplished and the major problems encountered as the USAAVNS prepares to conduct training in a new Army aircraft.

YOU BUY 'EM — we fly 'em." Perhaps this should be considered as a new motto for the U. S. Army Aviation School! It doesn't smack of tradition or esprit, but it's just as apropos — perhaps even more so. Within the past few years, the Army has procured a variety of flying machines, including the UH-1, CH-47, CV-2, and the OV-1. Others being considered include an LOH, a heavy lift helicopter, and a high speed helicopter. That's quite an assortment, when you stop to think about it!

Actually, we at the School wish it were as simple as "You buy 'em — we fly 'em." This statement, however, deceptively oversimplifies the problems involved in the establishment of a

training program for a new Army aircraft. It infers that the USAAVNS has an inherent capability to conduct a training program for anything that might be procured. And so we can (we think, at least), but ONLY if we receive assistance and consideration from many other headquarters and agencies.

The ultimate goal of any aircraft procurement program is to place in the field equipment which can be used to accomplish a useful mission. Before this goal can be accomplished, four vital areas must be considered: procurement of the aircraft itself, provision for support of the aircraft in the field, training of aviators to fly it, and training of mechanics to maintain it.

Procurement involves the "big" money; gets the publicity — and logically so, because this is the news of the day and our way of life tomorrow. In achieving the ultimate goal, however, procurement is no more vital than are support and training requirements. Each area is vital, and each must be planned and coordinated with the other.

Let's pick a point in time, say 1975, and assume that a requirement for a training program for a new Army aircraft will exist at that time.

SPECULATION

When proposals indicating a new aircraft could be built for use by the Army are received at Fort Rucker, USAAVNS aviators become involved in some very serious hangar flying sessions. These discussions include such items as how nice this piece of equipment would be, what it could be used for, how fast it would fly, and how heavy a load it could carry.

Capt Setzer is with the 16th Avn Bn, Stuttgart, Germany.

Other aviators and interested persons are probably looking at these proposals at the same time. Individuals in Army Materiel Command could probably conclude, for instance, that we could never afford it, regardless of how nice it would be. Those in the Combat Developments Command probably start wondering how we could justify a procurement program. At the U. S. Army Aviation Materiel Command (USAAVCOM) I'm sure that individuals decide (subconsciously at least) that such a monstrosity could never be supported from a maintenance and supply standpoint.

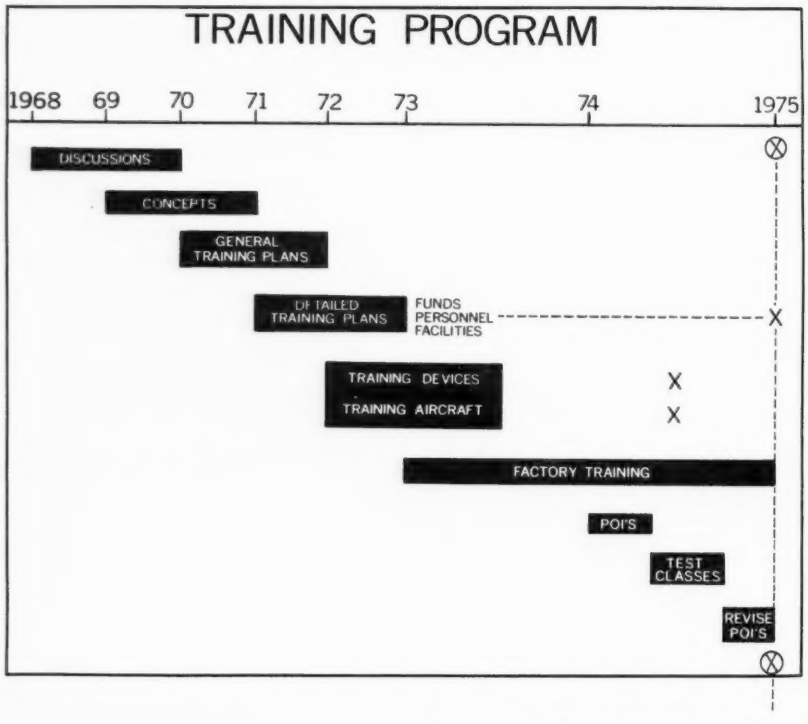
Meanwhile, back at the USAAVNS, thoughts logically turn to such questions as: I wonder how it would handle? I wonder where the instructor pilot sits? or I wonder what MOS the mechanic would carry? Although the productive results of these bull sessions are negligible, the first ideas and thoughts about training are generated at this time. It is surprising how many of these ideas may filter through to later become concept, then plans, and finally facts.

Althought the time frames in which these "actions" take place may vary considerably, an average seems to be 5 or 6 years before the training requirement. So, let's place it in the 1968 to 1970 time frame. This period of time and others which will be discussed are shown in chart form so each can be related to the others and to the date the training requirement actually will exist.

CONCEPTS

At the USAAVNS, the first serious thinking about the upcoming training requirement takes place when the headquarters is asked to comment on QMRs, plans of test, or other correspondence pertaining to proposals for new aircraft.

Formal training concepts are developed, training implications are discussed, and even a very limited and general training plan may be developed at this time. The time frame during which



this type of action occurs also varies considerably from one program to another. However, this normally takes place 4 or 5 years before the actual training requirement exists — in our hypothetical example: 1969 to 1971.

GENERAL TRAINING PLANS

Following this, the USAAVNS will continuously refine the training concepts which have been developed. By 1971 or 1972, the first formal general training plans will have emerged. During this period a test and evaluation program conducted by the U. S. Army Aviation Test Board may begin. School personnel usually will participate in this test on a mutual assistance basis. USAAVNS will provide aviators to assist in the flight evaluation of the aircraft and in return gain much valuable information on which more detailed training plans can be based. Much of this information could not be obtained in any other way.

This type of mutual assistance program is currently in effect in the LOH evaluation program. In other programs (e.g., CH-47 and OV-1), the test and evaluation program may be conducted concurrently with delivery of aircraft to the field. In any case, it is during this time frame that the USAAVNS begins the actual planning for this program.

Most people are surprised to learn that the USAAVNS develops actual training requirements three to five years before its first actual training plans. And, it is at this point that the USAAVNS encounters the first of several major problems: a lack of basic, fundamental information on which logical and complete plans can be based. It is known that a requirement is forthcoming, although it is not known that it will occur in 1975. The school usually does not know the aircraft production schedule, the distribution plan, the aviator or mechanic training requirements, and may know very little about the machine itself. In fact, almost nothing may be known except that some training requirement will exist, at some future date.

Training plans include requirements for personnel, funds, facilities

Other than the School, the average person still isn't too concerned with the training program at this time. Training is something still far in the future, and the more current problems of politics, procurement contracts, funds, provisioning, etc. loom so much more important.

This is logical, but only to a point. Certainly the training program is not a problem at this time, and no immediate flap will be generated if some training considerations are omitted. Nonetheless, detailed training plans must be developed in this time frame, from whatever information is available. Many problems could be avoided if more emphasis were placed on preparing valid training plans at this time. These training plans, prepared some three and four years in advance, are subject to change (to say the least); but it is sometimes quite surprising how the basic concepts emerge unchanged.

The end of this group of actions (entitled "General Training Plans" on the chart) moves us in the late 1971 time frame, about three years before the actual training requirement.

DETAILED TRAINING PLANS

Detailed training plans evolve from the general plans as more and more requirements are considered in detail. Let's examine these detailed training plans, look at some of the major problems, and see why they must be considered so far in advance.

In almost any plan, three common requirements must be considered: personnel, funds, and facilities. Every training plan developed by the Aviation School must state its requirements for additional facilities, such as airfields, stagefields, hangars, barracks, BOQs, etc.

Some of these requirements are quite difficult to determine because of the lack of planning information. For example, if the training requirement in 1975 is going to be large enough to require an additional stagefield, this facility should be programmed well ahead of time. The ideal time would be 1971 or 1972; 1973 is the latest that it can be programmed with any reasonable assurance that it will be completed by the time it is required.

With no definitive mission, it is impossible for the USAAVNS

to justify additional construction. So, the planning continues in the hope that the upcoming requirement can be satisfied using only existing facilities, or that, the additional facilities can be obtained at the last minute.

Similarly, funds and personnel requirements must be considered well ahead of time. TD changes are notoriously slow to be approved, and budgets also must be planned and approved well in advance. All of this planning must be done at the USAAVNS, with whatever information is available at the time. Rarely is this information sufficient to permit the development of a valid, comprehensive plan. So, without belittling at all the importance of these three items, funds, personnel and facilities, I will move on to discuss training devices and aids, and then aircraft and training requirements.

TRAINING DEVICES

The leadtime necessary for training devices means that many decisions and actions in this time frame must be based solely on past experience and judgment, and/or recommendations which come from the manufacturer of the aircraft itself.

The manufacturer is vitally interested in the success of the training program because it affects the ultimate success of his product. Yet, his separateness from the Army's training program requires that the USAAVNS rely to a great extent on past experience and judgment to determine whether or not the manufacturer's proposals seem reasonable and logical, and to determine what devices and aids should be procured.

In the case of the CH-47, for instance, procurement was based almost exclusively on the manufacturer's recommendations. Discussions between the manufacturer's representatives and USAAVNS personnel covered several weeks of full-time effort to finalize training device requirements. Depending on the manufacturer to this degree is not a desirable situation. However, in some cases there is no logical alternative, because at this point in time only he really knows the complexity of his machine and what will be required to teach individuals to fly and maintain it.

In contrast, the USAAVNS statement of requirement for LOH training devices was based solely on judgment and past experience. There was almost no other information available, and no manufacturer from whom to obtain recommendations. The undesirable aspects of procuring training aids and devices on this basis are obvious. However, the long leadtime involved, coupled with the scarcity of information at the time, left very little choice.

A possible solution to this problem has been proposed by the U. S. Army Ordnance and Guided Missile School, in a proposal concerning the procurement of weapons systems in general, which could very well apply to the procurement of a new aircraft. This proposal would require the manufacturer of an aircraft, by contract stipulations, to conduct a Task and Skill Analysis (TASA) on his product, to determine in detail what tasks physically must be performed in flying and maintaining his product.

Next he would conduct a Training Aids and Device Study (TADS) to determine which of these tasks could be taught most effectively by using training aids and devices. He would also recommend a list of aids and devices for procurement.

The manufacturer would be required to provide all of this information to the U. S. Army for its consideration before a contract for training devices would be considered. The use of the TASA and TADS, if proved feasible, should eliminate some of the guesswork which typifies current training device procurement methods.

TRAINING AIRCRAFT

Every training plan must include consideration of major items of equipment required to support that plan. At the USAAVNS the major concern in this area is aircraft, including flyable aircraft for the pilot training program and flyable and/or nonflyable maintenance trainer aircraft. It is vitally important that training requirements be considered whenever aircraft distribution plans are developed.

The magnitude of the training program is directly proportional

Valuable information on detailed training plans is gathered when USAAVNS and USAAVNTBD mutually participate in evaluation of new aircraft

to the aircraft devoted to it. The Aviation School can plan to train 1,000 aviators per year, using 100 aircraft; but if only 50 aircraft are allocated to the training fleet, only 500 (or fewer) aviators will be trained. Mechanic training follows the same pattern — more equipment, more training; less equipment, less training. As a result of this direct relationship, several different training plans may be developed before any single one is implemented.

The most logical basis for development of a training plan is one in which the School is told how many aviators and mechanics must be trained during a given period of time. It then develops a plan to meet this requirement, working backward to determine how many aircraft will be required to support the training program. Any other planning basis almost certainly will produce a plan which does not satisfy the training requirement, and therefore produces problems later.

Obviously, any decisions concerning the distribution of aircraft which do not consider all of these details will have a very definite effect on the training program.

FACTORY TRAINING

Let us assume that, by this point, the general training plan has been developed to provide the correct number of trained aviators and mechanics at the right time; funds, personnel and facilities have been programmed; aircraft have been provided for; and everything is fairly firm. The School now has to consider the many aspects of the multifaceted term "training."

Training considerations must include factory training, instructor training, and finally student training. First, it must be determined what type and how much factory training is required for how many people. As with the training devices, the USAAVNS is forced to rely to a great extent on recommendations from the aircraft manufacturer. The USAAVNS can disagree with his recommendations only in those cases where past experience and judgment (again relying on these two) indicate that this suggested training may be too little or too much. On this point the USAAVNS often receives advice and assistance from other interested agencies, particularly the U. S. Army Board for Aviation Accident Research and the U. S. Army Aviation Human Research Unit.

Experience with some programs has proved that factory training did not include enough flight hours, did not include enough maintenance instruction, or was too loosely controlled, etc. These experiences are used as a basis to evaluate the factory training proposed by the manufacturer of the next new aircraft.

The content of the factory training is determined by the manufacturer of the aircraft, which creates a particular weakness in the flight training program. The manufacturer of an aircraft usually will devote the largest portion of the factory training program to the flight regimes in which the aircraft performs best, and the lesser portion to those regimes in which the machine is marginal or unsatisfactory. The Aviation School, in its training program, may eventually do just the opposite; however, in the factory training program, we are obliged to take whatever the factory instructors provide.

PROGRAMS OF INSTRUCTION

After the detailed plans have been made, the training aid and device requirements have been stated, the personnel, funds and facilities problems have been solved, and the factory training has been completed, the USAAVNS is prepared to settle down to develop programs of instruction. A relatively long period of time is planned for this stage of things; however, it just never seems to work out that way.

This has been true in every case so far, and is almost certain to be the case in the future.

Nonetheless, the USAAVNS develops its POIs, and in almost every case manages to run a test class using School personnel. This test class serves two purposes: It evaluates the POI itself, and it begins the USAAVNS on its internal training program to provide additional qualified instructors, for both the flight and maintenance training programs. Once this training is accomplished and the training aids delivered, the additional personnel assigned, funds made available, facilities built or allocated to this program, and students received, the Aviation School is then prepared to implement the training program.

SUPPORT

This might seem to be a logical place to end this article; however, this point in the training program does not represent the end of problem areas to be

encountered. In fact, it merely introduces the last of these persistently recurring problems — support to keep the training aircraft flying, training devices working, etc.

In almost every instance, training has been delayed, hampered or curtailed because of support problems, usually because of a shortage of parts. These problems exist, have existed, and will exist. But, from the Aviation School's viewpoint, these questions arise: Are these problems, in the usual severity and seriousness of consequence, completely unavoidable? Must they exist? Must they recur, in the same magnitude, with every new aircraft?

We would like to think that the Army will benefit from experience, and that the next training program, probably for the LOH, will not be so severely hampered by the same problems.

I do not propose answers to the problems discussed because I do not know the answers. In fact, I suspect that there are no all-encompassing answers; no panacea. Perhaps someday you may be in a position to help eliminate some of the problems before they occur, or reduce the magnitude of their impact on the training program. Any action in this area will be your contribution to our common goal: a better equipped, better trained, and more capable Army Aviation.

Even buying off-the-shelf aircraft requires considerable time for factory, instructor, and student training

Setting the magneto timing and contact points while they are mounted on the aircraft leads to high fuel and oil consumption, shorter engine life, and aborted missions.

TIME IT RIGHT AND SAVE THE FLIGHT

CWO-2 Clarence J. Carter

HAVE YOU BEEN on that obscure pad or strip way out in the boonies and had to turn to a high ranking, nonrated VIP and try to explain that you couldn't take off because of excessive mag drop or fouled plugs? You must admit that it is hard for the VIP to understand why you have ignition problems after a few hours when he drives his car thousands of miles without noticeable troubles.

In most cases, you have been a victim of improper ignition timing. The basic function of the ignition is to deliver the proper amount of electricity to the proper spark plug at the proper time.

Most of us have found that the engine will let you know in short order if the proper sequence has been interrupted or rearranged. This is true of any engine with an ignition system, but since the aircraft engine has a dual ignition we must remember that a large number of small problems may be hidden to the mechanic.

To develop peak voltage the magneto must be internally timed to take full advantage of its magnetic field. This condition is met by setting the "E" gap or the contact points to open at the point of greatest magnetic shear. This allows the highest voltage to pass through the distributor to the proper ignition lead at the proper time.

The aircraft engine requires about 11,000 volts at the spark plugs while operating in a no-load condition, 13,000-15,000 volts at cruise, and about 18,000 volts at maximum power. This demand is generated due to the changing pressures within the cylinders under different load conditions.

This condition may be observed on the engine by use of the ignition analyzer, or more directly on a pressure type spark plug tester. A given plug may fire perfectly under 60 psi but may stop firing completely when the pressure is increased to 100 psi. This is due to the increased electrical resistance of the more closely packed air molecules at the higher pressure.

Remember, the spark plug's ability to fire under pressure is dependent on the amount of voltage it receives from the magneto. This is why the aircraft magneto must be bench-timed by referring to the proper TM. If it is set at anything less than perfection, it will not produce peak voltage. It must be removed from the engine to be properly timed.

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Now that we have the magneto producing its designed peak voltage of about 20,000 volts, let us see how we can meet the equally critical requirement of getting this voltage to the proper plug at the proper time.

By comparing the aircraft ignition system with the automotive system, we can see why the proper timing of the magneto to the engine is so critical.

The automotive type engine employs a means of automatically advancing and retarding the position at which the spark plug fires relative to the position of the piston. This device is necessary on the engine because of the rapidly changing pressures within the cylinders under different load conditions. This is due to the different burning speed of the fuel under different pressures, and there must be a means of controlling ignition of the fuel so that peak power may be realized at the proper position of the piston on the power stroke.

Therefore, incorrect timing of the automotive engine is often hidden by this shifting of plug firing. This is not true of the aircraft engine. It isn't practical to employ the automatic advance device due to the increased number of moving parts and the reduced acceleration requirements of the aircraft engine. Therefore, the magneto is mounted on the engine to produce the most desirable ignition at the most used power setting. (Full power requirements are met by the automatic enrichment feature of the carburetor or fuel system.) For this reason the properly timed aircraft engine will run a little rough at low rpm.

Now we see why it is most important that the TM be used in all timing procedures. The ignition analyzer is the only device that will give an accurate picture of the performance of the ignition system in flight. Very few Army aircraft are set up for inflight testing, so the procedure in the book is the only one to use. (These aircraft can be set up for inflight testing: U-1A, CV-2, CH-21, CH-34, CH-37.)

Although incorrect, it is becoming more and more prevalent throughout Army Aviation to set the timing of the magneto and contact points while they are mounted on the aircraft. This can only lead to high fuel and oil consumption, shorter engine life and aborted missions.

Time it right and save the flight — and perhaps the Army Aviator.

Don't forget the . . .

BELIEVING that passengers like to know what's going on in the cockpit, many airlines pipe the flight crew's radio transmissions into the cabin PA system thus allowing the passengers to listen-in.

A recent issue of the British "FLIGHT International" included a letter written by a lieutenant in the Royal Navy. We pass his words on to you:

"The passenger is as likely to be surprised by what he hears over the R/T as to be interested. This was borne out when a pilot in Australia allowed the passengers to listen in to his controlled approach to an airfield. The excitement of the approach had made him forget that he was 'live' to the cabin, and as he rolled to the end of the runway he informed the copilot and some 30-odd passengers that . . . 'What I want now is a cold beer and a hot woman.' The hostess, who was already walking toward the forward cabin, broke into a run to remind the pilot that he was still talking to the passengers, when someone in the second row called, 'Don't forget the beer!' "

—Flight Safety Foundation Inc.
Accident Prevention Bulletin 64-8
August, 1964

Standardized Helicopter Stick Grips

Major Fred W. Leuppert

THE MANUAL dexterity required to cope with the rash of buttons, knobs and switches now appearing on helicopter control sticks almost demands that aviators be "piccolo qualified."

One of the by-products of the development of Army helicopters has been an increase in the number of controls which must be immediately available to the aviator during flight and assigned tactical missions. Due to the unstable nature of the helicopter, these flight, communications, and armament controls must be included on the cyclic and collective pitch control sticks.

	RADIO ICS	FORCE TRIM	HOIST	CARGO RE.	STAB. TRIM	STAB. RE.	LANDING LGTS.
OH 13	1						
OH 23	1	3					2
UH 1	1	2		5			
UH 19	1		3	4			
CH 21	1	2	3	5		4	
CH 34	1	4	3	2		5	
CH 37	1	4	3	2		5	
CH 47	1	4		5	3	2	
CH 54	1						

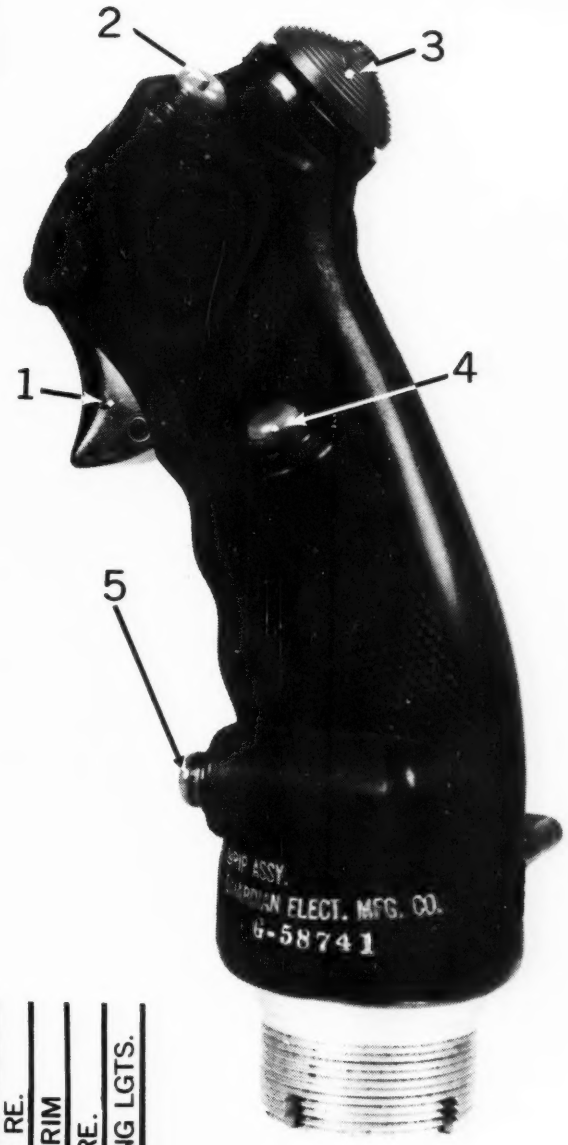

Figure 1

Illustrations of different locations of cyclic stick grip controls on various helicopters

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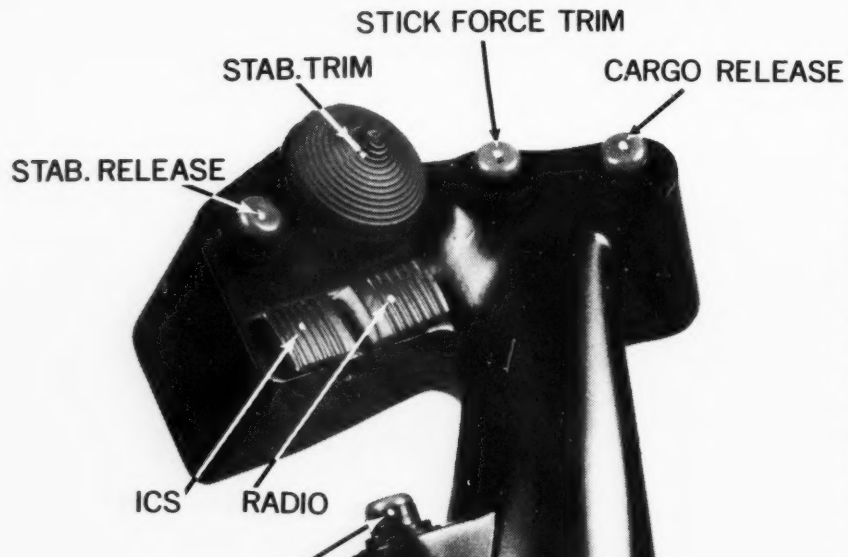


Figure 2. Possible cyclic control stick grip configuration. Inset: View of reverse side

The various manufacturers of Army helicopters have incorporated the necessary functions in their stick grips; but each has developed a different arrangement, leading to areas of possible confusion to multiqualified Army Aviators (fig. 1). The use of armed helicopters has aggravated this situation, emphasizing the need to standardize helicopter control grips from the aspect of safety, increased capability, and man-machine integration.

This article will present highlights of a study by the U. S. Army Aviation Test Board (USAAVNTBD) to determine what *minimum* functions should be incorporated into standardized Army helicopter stick grips, and the progress of the U. S. Army Human Engineering Laboratory, Aberdeen Proving Ground, to develop hardware to meet these requirements.

The purpose of the Board study was to evaluate all control grip switch functions used in present and projected Army aircraft and reduce the number of functions to an absolute minimum. To preclude a need for piccolo qualification for helicopter pilots, each possible switch function was judged by these criteria: wide or potentially wide usage of the function, whether it required actuation while the pilot is in direct control of the helicopter, or whether the switch required immediate actuation as a matter of safety.

The USAAVNTBD concluded that a standardized cyclic control stick grip should include facilities for the seven following functions. (Method of actuation and location, where specified, as outlined in the Military Standard MIL-STD 250 B, "Military Standard Cockpit Controls, Location of and Actuation of, for Helicopters.")

Cyclic function 1. A communications function, located on the after (pilot's) side of the grip. The switch should be of a three-position type for selection of radio transmission, intercommunication, and off.

Cyclic function 2. A stick positioner function, push-to-actuate type switch. The stick positioner is variously known as a Force Trim Switch or Trim Release Switch and controls the operation of a magnetic brake and spring configuration which, in effect, trims the cyclic stick.

Cyclic function 3. A cargo hook release function, push-to-actuate type switch. The inclusion of a switch for this function for helicopters equipped with external slings is obvious.

Cyclic functions 4 and 5. Stabilization equipment trim and release functions, the trim switch to be of a four-way "Chinese

Hat" type, and the stabilization release a push-button type. The increased requirement for stabilization equipment for instrument flight, for aerial surveillance, and for providing a stable weapons platform implies more widespread installation of stabilization equipment. As a matter of safety, controls for stabilization equipment should be immediately available to the pilot.

Cyclic function 6. Gun-firing switch, trigger finger position, squeeze-to-actuate with provisions to operate a gun camera. Guns ranging in caliber from 7.62 to 40mm have been successfully fired from almost every type Army helicopter, using any available stick grip switch as a trigger. Standardization of trigger configuration is imperative in the interest of safety.

Cyclic function 7. A rocket-firing switch in the thumb position, press-to-actuate type. In addition to the guns mentioned, various rocket armament systems have been fired from helicopters, some in conjunction with gun type weapons. To provide responsive selectivity of weapons, a separate rocket switch should be provided.

The USAAVNTBD study also covered the area of standardized collective pitch control stick grips. Of the many functions now actuated by switches on the collective grip, the following were concluded to be the minimum for a standardized collective grip:

Collective function 1. Throttle, of a rotary type, for single engine helicopters. Multiengine helicopters could have a throttle panel on the center console.

Collective function 2. Electric speed trim switch(es), also known as beep trim switches, are characteristic of helicopters with turbine powerplants and should be available to the aviator while he is in direct control of the aircraft.

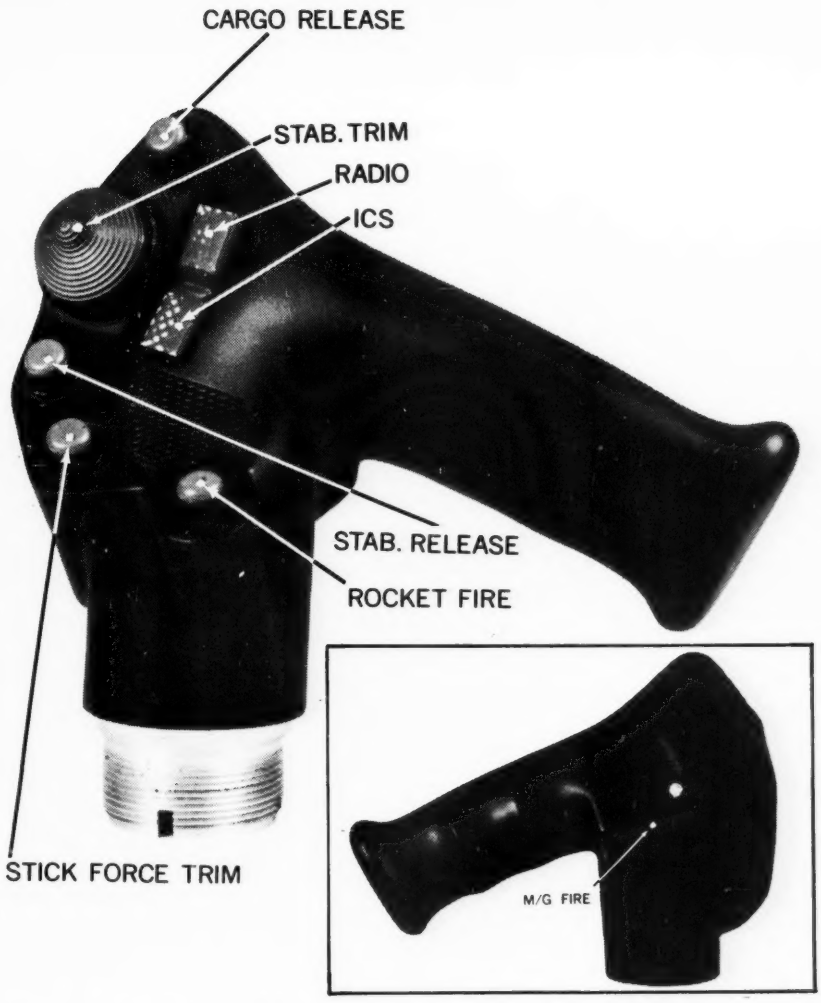


Figure 3. Another possible cyclic control stick grip configuration. Inset: View of reverse side

Collective function 3. Starter switch, for single engine helicopters, should be included to provide air start capability. Starter switches for multiengine helicopters may be located on a starter panel.

Collective functions 4 and 5. Landing light and searchlight switches probably show the greatest variance in today's helicopters. A simple on-off landing light switch, with an automatic extend - retraction operation if necessary, and an on-off switch and a "Chinese Hat" sweep control for a searchlight should be devised for a standard collective grip.

Collective function 6. An elevation-traverse switch for armament systems should also be included to allow a helicopter pilot to aim his guns while in direct flying control of the helicopter. Tests at the Board have indicated that this necessary facility cannot be successfully operated on the cyclic grip because of adverse effects on the helicopter flight attitude and must therefore be included on the collective.

None of the cyclic and collective grips currently installed in Army helicopters meet the re-

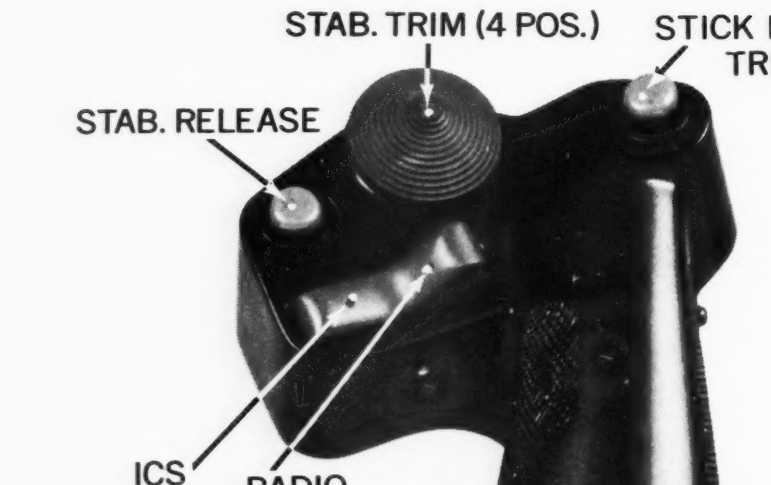


Figure 4. Still another possible cyclic control stick grip configuration. Inset: View of reverse side

quirements for a standardized grip. The Board study concluded that two standardized cyclic control stick grips should be developed, one for observation helicopters and the other for utility/cargo helicopters — the latter being an elaboration of the first.

The standardized cyclic grip for observation helicopters should include the following functions: voice communications (after side of grip), gun firing (right forefinger position), stick positioner. The standardized cyclic grip for utility and cargo helicopters should include these additional functions: cargo hook release, stabilization release, stabilization trim, rocket firing (right thumb position).

The board concluded that one standardized collective pitch control grip should be developed for all Army helicopters; and all functions of standardized cyclic and collective grips which are not applicable to the particular helicopter should be replaced by a blank panel, allowing the option of switch installation when necessary.

The standardized grips should have a quick-disconnect facility from the end of the control stick to permit easy replacement and interchange of the grip. General cyclic control stick grip design should be of an additive scheme, with a plug-in adaptive unit to provide the additional utility/cargo functions to the observation helicopter cyclic grip.

The U. S. Army Aviation Test Board has not attempted to design or construct standardized grips. The U. S. Army Human Engineering Laboratory has recently taken the Board study and has converted its findings into mockup hardware for later test, evaluation, and selection of the most acceptable standardized grips. Some possible cyclic control stick grip configurations are illustrated below (fig. 2 thru 7).

The U. S. Army Human Engineering Laboratory has determined that one satisfactory grip can be developed for all helicopters. Those functions not required for a particular helicopter would be "dummied" with a blank panel or cap. Safety devices, such as trigger guards, are incorporated on certain switches. Other switches, such as the external cargo release switch, are located to require a definite movement of the hand to actuate, precluding inadvertant operation.

Beyond the scope of determining requirements and constructing anthropometrically correct mockups, the factor of pilot acceptance is of vital importance. No matter how much effort is expended in the design of the standardized grip, the final product will be worthless if it isn't better than the old grips. In this regard, the U. S. Army Aviation Test Board, Fort Rucker, Ala., and the U. S. Army Human Engineering Laboratory, Aberdeen Proving Ground, Md., solicit your comments.

Continued from page 11

he saw the powerline looming dead ahead. Full power was applied, sparks flew, power was reduced; and although initial touchdown was short, landing was completed. Two hours later the grass fire which resulted from the broken powerline was extinguished, the aircraft was inspected, and damage was found to be incidental.

You are no doubt thinking: What a lucky son-of-a-gun! Just another case of poor judgment! Definitely pilot error! You are probably correct on all counts. The results could have been much more serious, and the aviator wasn't exactly proficient in strip landings day or night.

Lieutenant Notsoproficient had not made a night strip landing in 6 months, a day strip landing in 4 months. Unit policy forbad field strip landings "unless necessary to accomplish the mission," and the missions flown by this unit were 90 percent administrative. The only night strip work authorized was that in conjunction with a unit field exercise. Two such exercises had been conducted in the past 4 months — without aircraft, however, due to inclement weather.

An aviation unit commanded by Captain Meanswell had an excellent safety record; that is, until Lieutenant Notsolucky nosed an aircraft over while attempting a road landing. Shortly thereafter came a unit policy requiring 500 hours of first pilot time before making any road landings. While obviously designed to improve the unit's safety record, this policy restricted any newly rated aviator assigned to the unit from maintaining his road strip proficiency for a year or possibly longer, depending on how fast he accumulated his 500 hours first pilot time.

Captain Lotsofexperience took command of an aviation unit which also had a commendable safety record. This was not surprising considering that most of the aviators assigned were well seasoned veterans and had considerable tenure in the unit. To prolong this good record Captain Lotsofexperience, desiring to share his flying knowledge with his aviators, promptly drafted a new policy requiring all aviators to use new power settings, a new cockpit procedure, and numerous new flying techniques that had given him good results in his many years in Army Aviation. During Captain Lotsofexperience's period of command, the incidents that occurred were too numerous to mention; three major accidents occurred, one of which involved a fatality.

Again I ask, can safety be overemphasized? I would answer this with an emphatic NO. But individuals responsible for establishing flying policies and regulations must recognize that for an aviator to maintain his ability to safely utilize his flying machine to its maximum effectiveness, many hours of flying, at regular intervals, in confined areas and under adverse conditions will be required. Inevitably, some incidental damage to aircraft and equipment over a period of time will blemish the safety record, but the unit will have aviators capable of operating under the most demanding conditions. Some serious accidents which might result from assigning Lieutenant Notsoproficient a hazardous mission might be averted.

Policies which may tend to discourage individuals from using unimproved strips or landing areas which challenge the aviator's skill, policies which change time-tested procedures, and policies which may discourage an individual from using his own initiative and judgment should be carefully considered. They may ultimately defeat the purposes for which they were intended. After all, what is the mission of Army Aviation? To have an accident-free record, or an operational unit capable of supporting the ground commander in the most demanding circumstances?

True, safety cannot be overemphasized. But it is one thing to build a safety record on a year of administrative flying in and out of 4,000-foot paved runways, most of it between 0700 and 1700 hours under VFR conditions. It is much more commendable to build a safety record, one which possibly includes a few incidents, during a year in which the unit received extensive field training; flew in and out of unimproved strips, day and night, under minimum lighting conditions and something less than the most desirable weather conditions; and accomplished a variety of tactical missions. Regardless of how safety records compare, the latter course will result in a unit which will have fewer casualties and be more effective in a combat situation.

Don't wait until you are in a combat situation to begin training for it. Unit commanders and other policy makers must be aware of the differences in pilot experience and the variety of missions an Army Aviator is expected to be able to perform. They must give their units and individual aviators the opportunity to evaluate their weaknesses, encourage them to make improvements in these areas, and then give them enough latitude to maintain their proficiency at this high level.

Survival Flaps

—A Way to Live

Major Dale E. Hucke

THE SINGLE most important consideration in successful survival is the will to live. This factor cannot be packaged and carried with you as an external attachment to your flight gear. It must be acquired through an immensely complicated set of circumstances that begins when you're born and continues up to the time you call on it to bring you through safely.

What the will to live consists of varies with each individual. At times of crisis you either have it, or you don't. The time to develop a strong will to live is before you have to call upon it. If, when faced with minimal chances of survival, you realize you *haven't* forgotten your survival kit, your will to live will suddenly receive a big shot in the arm. You realize these tiny items can be of tremendous value to you.

We can see a definite relationship of external aids to the basic will to survive. Training contributes because we use knowledge to dispel fear of the unknown and help reduce the odds. But how long can we remember the many ways to apply survival techniques? Under severe stress, we tend to forget some things while others, not necessarily related to successful survival, may be paramount in our thinking. We may start off in 15 directions at once, trying to recall from our training the proper steps in survival. If we've forgotten how to go about it, we'll become frustrated, and our will to survive is quickly lowered or undercut by fear.

Anything we can take with us to aid in survival is good. But there's a limit to how much we can carry. We should have everything we need and can carry. It would be excellent to have a manual along on successful survival techniques, but a manual is heavy and impractical. We need something that is lightweight, compact, and which includes considerable information on survival.

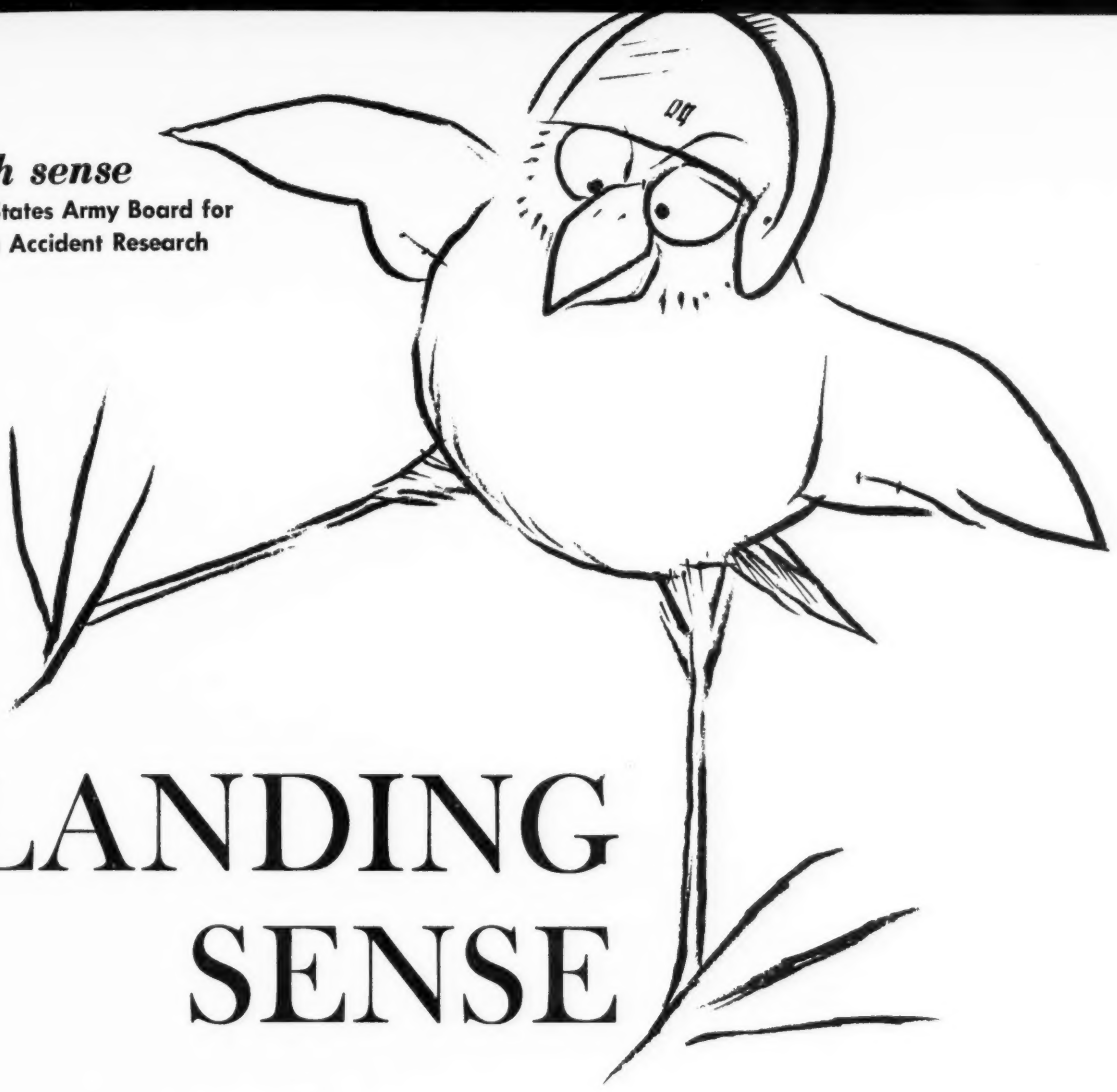
One thing we usually have with us, if we follow the flight surgeon's advice, is a flight suit. This brings us to the subject — SURVIVAL FLAPS. Survival flaps are flight suit pocket flaps imprinted with all basic survival instructions, instructions for everything from skinning rattlesnakes to finding true north, together with simple diagrams as needed. Printed both front and back, and sewn into the tops of flight suit pockets, they are completely out of the way. When needed, you simply reach into the pocket and pull out the flap, just as you would turn the pocket inside out. Smaller sizes containing less information could be made available for other uniforms, such as fatigues.

Material for survival flaps should be flexible as cloth, impregnated against fire, and able to withstand laundering. Each crewman could be issued several packets of the required survival flaps for each flight suit. New flight suits could be issued with the flaps installed. By printing instructions on both sides of the flaps for each of the flight suit pockets, a total of 12 surfaces would be available. And by separating the instructions into six pockets, the chances of losing all if a part of the flight suit is ripped away is reduced.

The specific contents of instructions to be printed on survival flaps are too many and varied to list here. The Department of Tactics, the U. S. Army Aviation School, has been conducting an excellent program in survival, and its personnel are highly qualified to provide the necessary instructions. The present course in survival is doing much to provide Army aircrews with the knowledge to survive. If we can now provide these same crews with the means to refresh this knowledge in times of stress, we may save additional lives. It seems worth a try.

Maj Hucke is USABAAR Liaison Officer to U. S. Army Aviation Materiel Command.

crash sense
United States Army Board for
Aviation Accident Research



LANDING SENSE

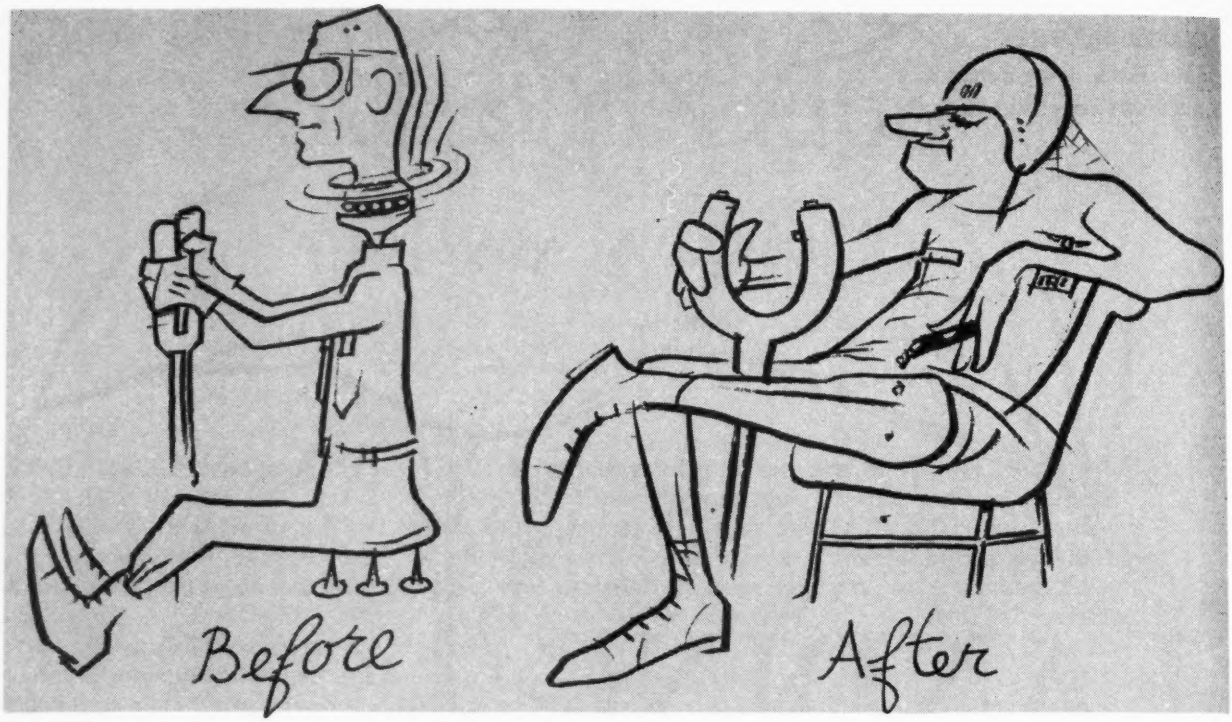
Major Chester Goolrick

Osborn

A common belief prevails that once a man acquires enough experience in his profession he becomes immune to the hazards attached to it, a guaranteed, built-in protection akin to being inoculated against hoof and mouth disease or wearing one of the handy magic suits of armor knights of old put on when they set out to rid the countryside of dragons. Acquire experience, the idea runs, and you can quit worrying.

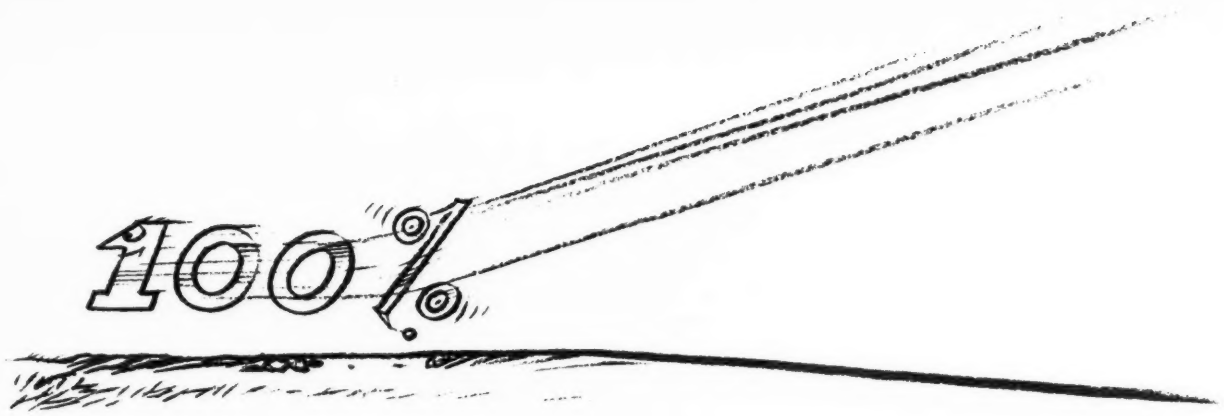
The difficulty with this comfortable doctrine is that it contains just enough truth to cause trouble. Experience is a nice thing to have in stock. When you are jetting across the Atlantic in a flying luxury hotel, the medium rare filet and champagne go down easier if you know the captain up front is a million-miler. Few ballplayers find out what it is like to patrol the outfield at Yankee Stadium without putting in long, hot summers learning how to catch flies and hit sliders in the bush leagues. The chap who sets out on a lone camping expedition in the Canadian northwest on the strength of a book he has read is likely to end up as a permanent entry on the log of the Bureau of Missing Persons.

But experience isn't everything. Not by a long shot. Sometimes it can even get in the way. The



more experience a man acquires, the more important knowledge he has in his mental storeroom to overlook. When he is starting out, when he is a fledgling at his trade, his equipment is so limited he is painfully aware of his shortcomings and he makes his moves with the gingerly care of a soldier crossing a minefield. After he has been on the job long enough to rate a testimonial banquet and a solid gold watch, he knows so much he can easily forget some small but important detail. One night he locks up the office and leaves the key to the safe on his desk.

This understandable, deplorable, and *preventable* human tendency applies to every job more



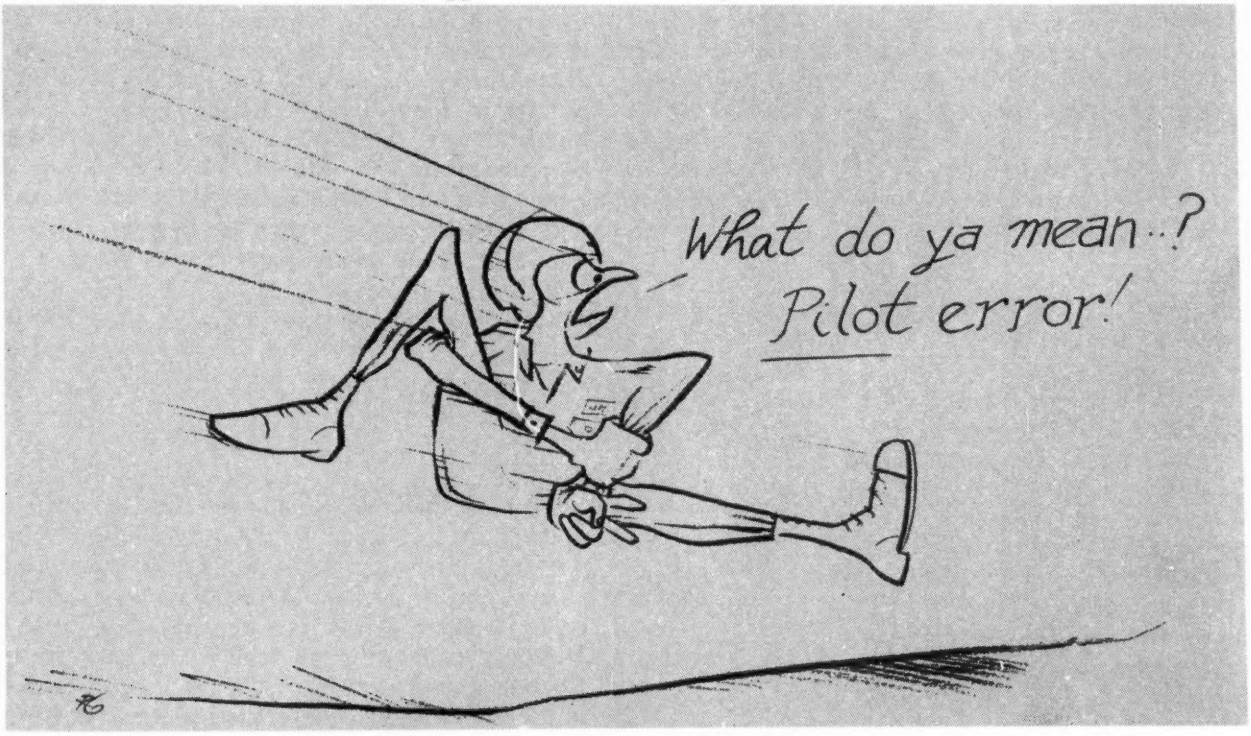
complicated than boiling water for the breakfast egg. It certainly applies to flying Army aircraft. Most particularly, it applies to *landing* Army aircraft.

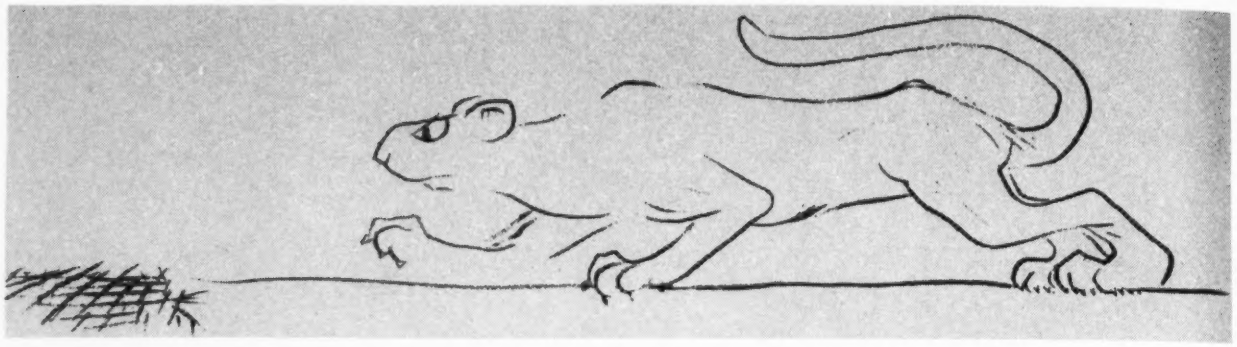
So

So the general philosophy of the thoughtful aviator is to build up a set of attitudes and action patterns which will keep him in the proper landing groove at all times, no matter what his degree of experience. It is hardly worth stating that every Army Aviator has the basic skill he needs to land the aircraft he happens to be flying at the moment. No one will debate the thesis that added experience can make the difference between a feather-smooth landing and a touchdown which looks as if it were being executed by a drunken kangaroo. Further, it dawned on each of us about the first time we climbed into a cockpit that a landing is far from child's play, that it is one aspect of flying which demands *total* performance.

Everyone, in other words, knows what is involved and how to take care of it.

Okay. Now account for the fact that a hefty percentage of Army flying accidents involves landing situations — and we are are not talking





about the unhappy lads whose aircraft give up the ghost over the Dakota bandlands or in the middle of Lake Michigan. *The majority of landing accidents take place under circumstances as normal as blueberry pie.* Pilot error? You can say that again, Buster.

In nearly every case
SOMEWHERE ALONG THE LINE THE PILOT WAS GUILTY OF AN ERROR IN PROCEDURE HIS TRAINING, EXPERIENCE AND INTELLIGENCE SHOULD HAVE LED HIM TO AVOID

To put it charitably, the poor chaps who have "normal" landing accidents generally never have got around to considering and applying the answers to four basic landing questions:

1. Where does a landing begin?
2. Where does it end?
3. What can go wrong?
   and
4. How do I avoid making the error?

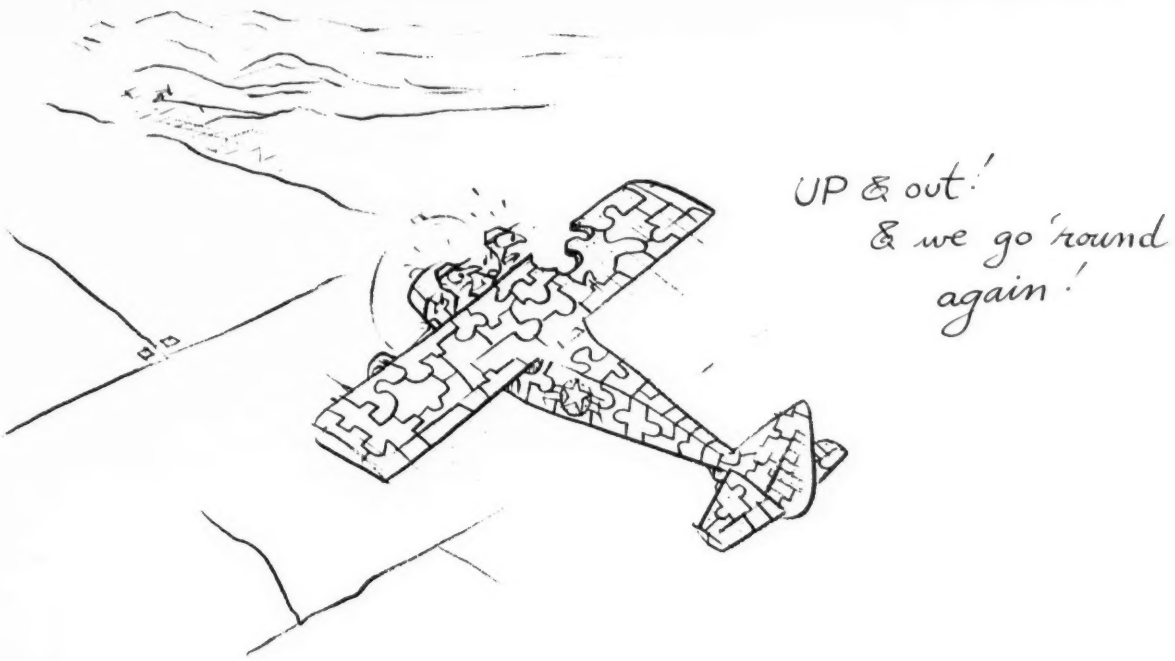
Man From Missouri

The positive thinker who asks himself these questions and equips himself with a set of solid answers does not acquire automatic landing accident immunity any more than the pilot who has managed to log his first thousand hours. What does happen is that as far as landings are concerned he is transformed into one of the earth's most suspicious souls. Under ordinary circumstances he may be the trusting type who invests in Patagonian uranium shares and believes his girl friend when she tells him she is a natural platinum blonde. When it comes to landings he suspects his aircraft, the landing area, and himself with a never-ending zeal which would do credit to Scotland Yard's finest.

He begins to acquire his attitude early in his question-and-answer session, about the time he realizes any landing analysis has two basic sides:

1. the landing process itself,
   and
2. the place to be landed on.

Like a good many other of life's knottier problems, this is more complicated than it sounds; in fact, it is so deceptively simple, an unwary aviator can put it in his own ho-hum-so-what's-new, or file-and-forget department. Every Army Aviator knows landing anything, from a Mohawk to a kite on a windy day, is a tricky piece of business at best. The sad truth is that the majority of landing accidents involves pilots



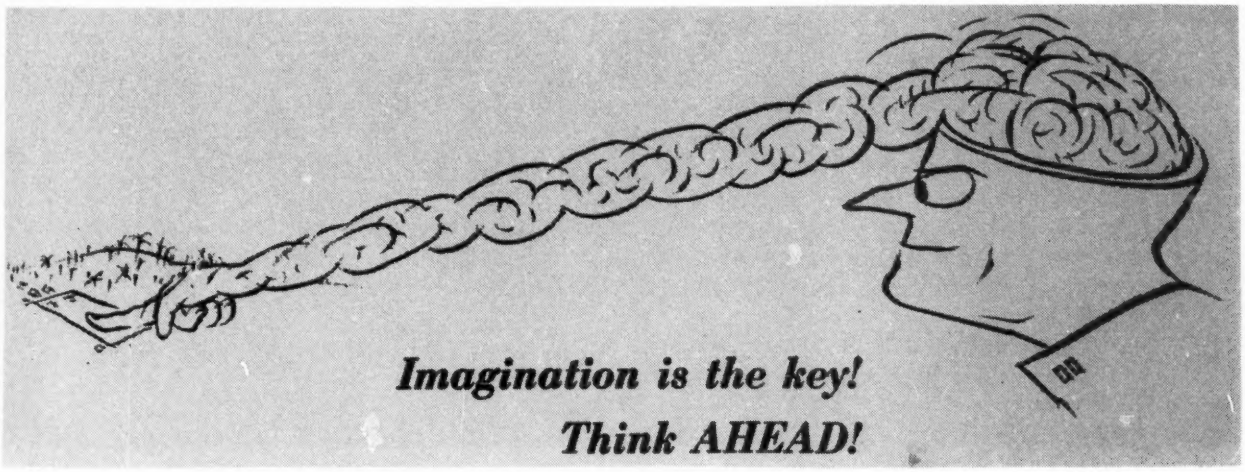
who have filed and forgot, who have borrowed trouble by overlooking or creating landing conditions they could have avoided with no more mental exertion than is required to avoid being run down in the street by a bulldozer.

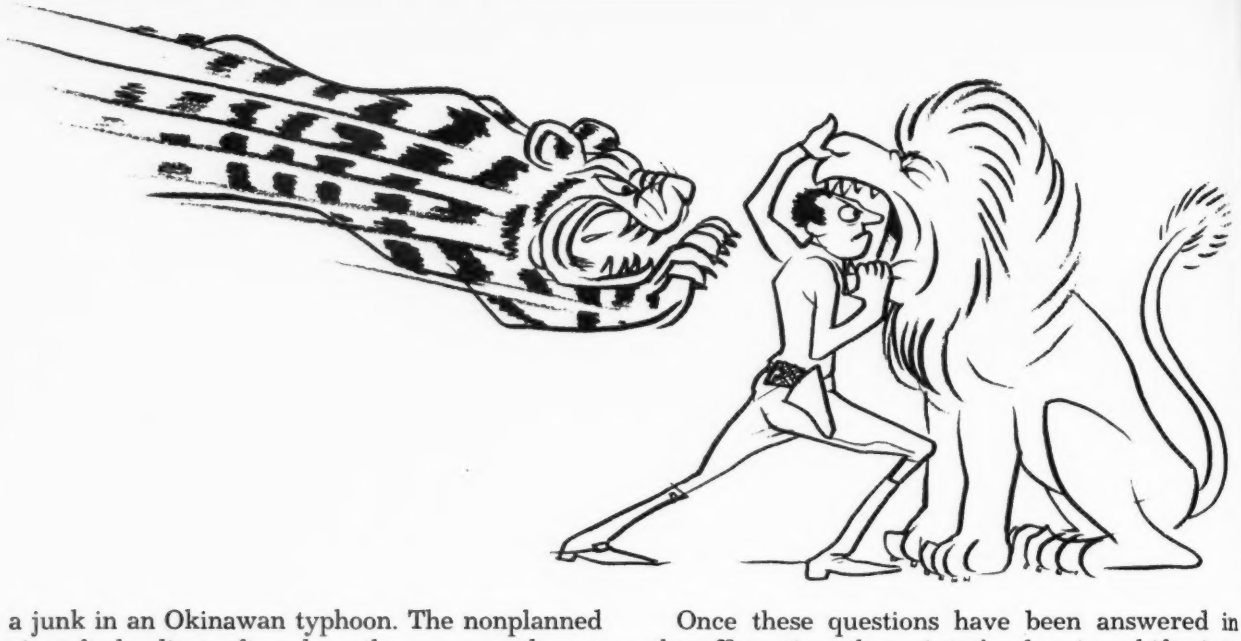
Our friend who has achieved a high-octane suspicion rating has the next best thing to automatic immunity. He *does* give the job of landing the extra thought it requires. As a result, he always conforms to Landing Law No. 1.

IF ANY ONE FACTOR IS NOT AS IT SHOULD BE, PILOT, AIRCRAFT, APPROACH, OR LANDING AREA, THE LANDING IS OFF

Planned Parenthood

The law applies from the *start* of a landing until the *finish* of a landing, which is another of those simple little statements, slick as a log across a creek. Nobody imagines any aircraft landing is an off-the-cuff action undertaken in the same carefree spirit as a plunge into the surf. Like most important actions, a landing has to be thought about in advance. Nobody gets married without considering the probability he eventually will be responsible for a brood of children who like to eat three times a day. Without proper planning, a marriage can founder like





a junk in an Okinawan typhoon. The nonplanned aircraft landing often has the same unhappy ending.

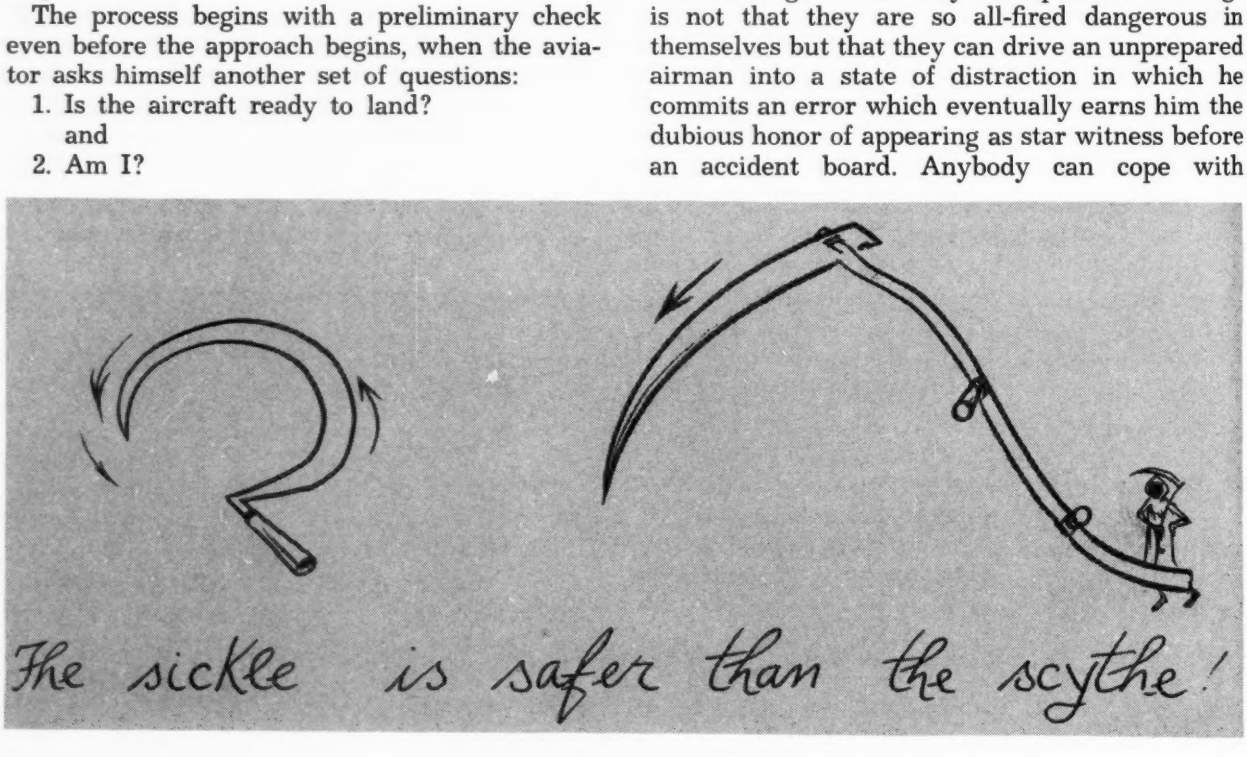
There are all kinds of planning, however. A poorly planned landing falls into the same class as a skyscraper designed by an architect who hasn't heard of that new-fangled contraption, the elevator. To be worth much more than a plugged Buffalo nickel, planning for a landing by the alert, suspicious Army Aviator becomes a *continuing process covering all factors which can keep the aircraft from getting down in the safest possible way.*

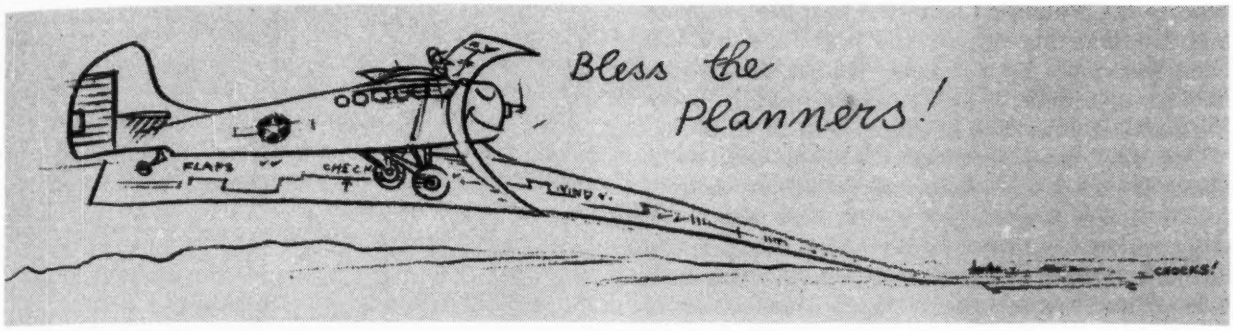
The process begins with a preliminary check even before the approach begins, when the aviator asks himself another set of questions:

1. Is the aircraft ready to land?
   and
2. Am I?

Once these questions have been answered in the affirmative, the aviator's planning shifts into high gear and becomes a technique in which he is planning to plan, to adjust to any of the two or three thousand unexpected situations which might suddenly arise. Every blue ribbon liner has a gyroscope in the hold working day and night to keep it on an even keel so the cocktails will not be spilled no matter how heavy the seas. Good planning techniques have just such a healthy stabilizing influence on landings.

The nasty thing about the various situations which can get in the way of unplanned landings is not that they are so all-fired dangerous in themselves but that they can drive an unprepared airman into a state of distraction in which he commits an error which eventually earns him the dubious honor of appearing as star witness before an accident board. Anybody can cope with



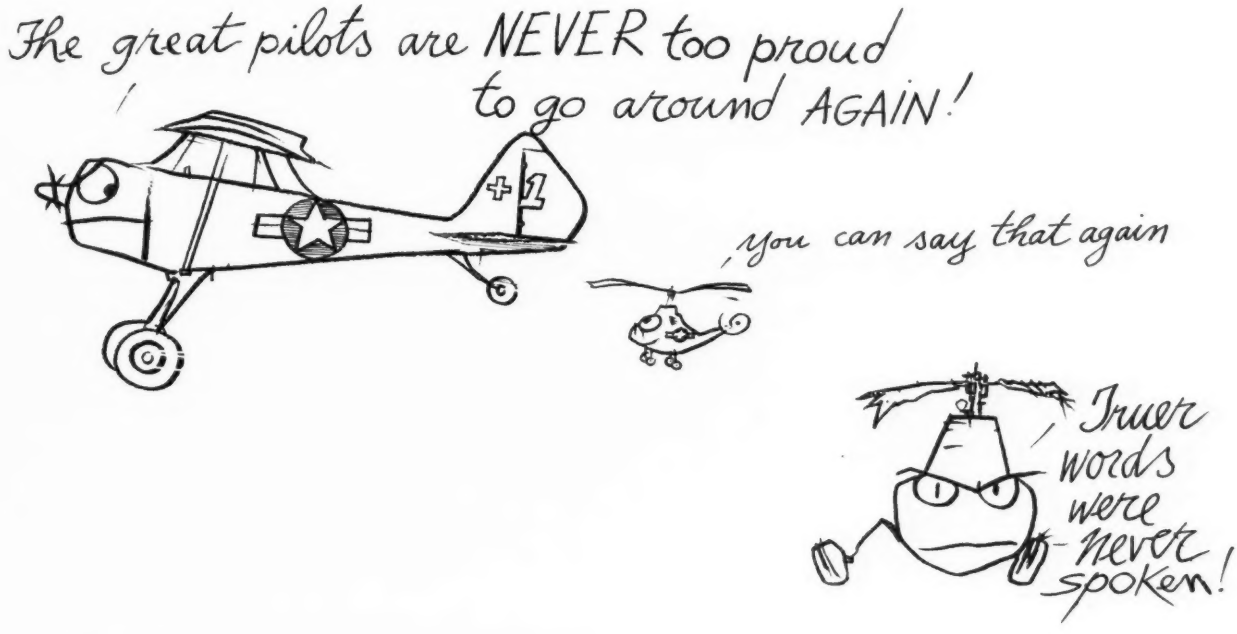


sudden turbulence or a shift in the wind. *When an aviator focuses his full attention on such factors to the exclusion of everything else,* he is in the same perilous predicament as the animal trainer who turns his back on the tiger while he is putting Leo the Lion through his paces.

Planning to plan equips an aviator to recognize a dangerous situation well before it is too late, to keep his attention properly divided, and to shift his course of action with the speed and grace of a star halfback if the need arises. Consider the happy story of an aviator who had developed a Grade A planning philosophy and who found himself not long ago headed for a nice landing on a temporary strip. He had begun his final when his personal gyroscope told him that before he could touch down he would have the setting sun squarely in his eyes and would have just about as much vision as he would at midnight. He gave up the effort, tried again, and made the landing with the sun at his back.

This sterling chap avoided the principal error committed by aviators whose planning is faulty or nonexistent — late recognition of a dangerous situation prompting hurry-up measures which rarely work. Flying has more than its share of hairy episodes which pop up from time to time and require last-ditch heroics on the part of the airman. The fact that he survives is evidence of his skill. The late recognition business is another matter entirely. In contrast to the aviator we have just admired, take the case of a CH-21 pilot who came in for a landing, allowed his airspeed to reach 85 knots and created less than the maximum glide angle. When his predicament dawned on him — too late — he applied aft cyclic in a hurry. The result was an excessive flare and a crash which woke every rooster within a radius of miles.

On another occasion, an Otter pilot encountered excessive turbulence while still well out on his approach. Instead of recognizing his situation he elected to plow grimly ahead, like a mailman in a blizzard. By the time he had wrestled the air-



craft to the ground he had gone past the TD point and found to his dismay the grass runway had been wet down by a shower. He sat through an extra-long rollout, a skid, and a groundloop the CO still reminds him of from time to time.

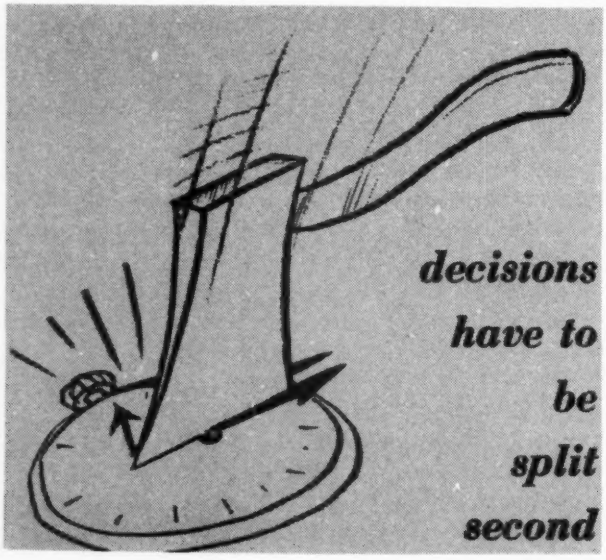
One final case involves the helicopter — a planning-conscious aviator never forgets a helicopter is less forgiving of errors than the fixed-wing with its built-in stability — which was the last in its flight to come in on a hot, dusty field during maneuvers. Each 'copter kicked up a little more dust, the density altitude had risen sharply since morning takeoff, and when the unfortunate soul last in line started down he suddenly found himself feeling like a catfish at the bottom of the Mississippi. Since it was too late to do anything about it, he sat there gamely in the murk until the helicopter found the ground by itself, tearing off a skid in the process. He learned the hard way that one or two aircraft often can land where ten cannot and now plans accordingly.

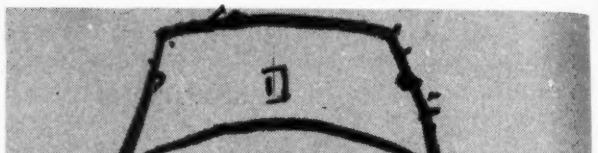
Any one of these accidents — in fact, nearly *all* accidents involving landings — could have been avoided by the aviator whose planning had equipped him to adjust and who above all was ready the instant the need arose to turn to that tried-and-true landing device, otherwise known as the Pilot's Best Friend:

THE GO AROUND

Try, Try Again

A feeling has existed in some aviation circles since the old barnstorming days that the go-around is a sign of weakness, like crooking your





little finger when you drink tea or being afraid of the town bully. The truth is that one mark of the mature, *really* strong thinker is a willingness to back off from a situation when his trained instinct and reason tell him the odds are getting too high for comfort.

Nobody but a compulsive gambler with a reject brain pours his life savings down a rat hole at Vegas or tries to retrieve his fortunes by drawing three cards to a flush. No pilot who fully appreciates the fact that the go-around is one of the most valuable tools at the disposal of the expert aviator ever allows false pride (as when he has a high-ranking passenger aboard) to prevent him from taking quick action when his judgment tells him the time has come to give up the landing he is attempting and have another try under happier conditions.

So a go-around is no reflection on a man's capabilities but a sound comment on his ability to size up a situation and do the right thing. A go-around means an aviator has the right kind of pride in his work. It shows also he has the maturity not to allow impatience — the entirely normal desire to get back on the ground in time for a dip in the pool before supper — to get in the way of the hard fact that tells him he would be far better off spending a few more moments in the air to ensure the kind of landings the textbooks talk about.

The go-around, then, is highly useful to any aviator from the time the approach begins until almost the moment of touchdown, provided he plans to use it if necessary. He keeps in mind that *a good landing is always preceded by a good*

approach and if something interrupts or interferes with the normal sequence of events, to go around cuts in as the top priority piece of business.

Here is one of life's moments when to delay means you lose all the marbles. As every aviator is aware, there are plenty of flying situations in which he can ponder his next move with the deliberation of a judge deciding whether to send a man up the river for life or let him off with a light sentence of 50 years. But the pilot knows that most of the time — notably on takeoff and landing — decisions have to be reached at a speed just a little faster than light. In the case of go-arounds, the situation may be stated in the form of a law the immortal Murphy might have given to the world if he had got around to it:

THE DECISION TO MAKE THE GO-AROUND MUST BE ARRIVED AT BEFORE IT HAS TO BE MADE

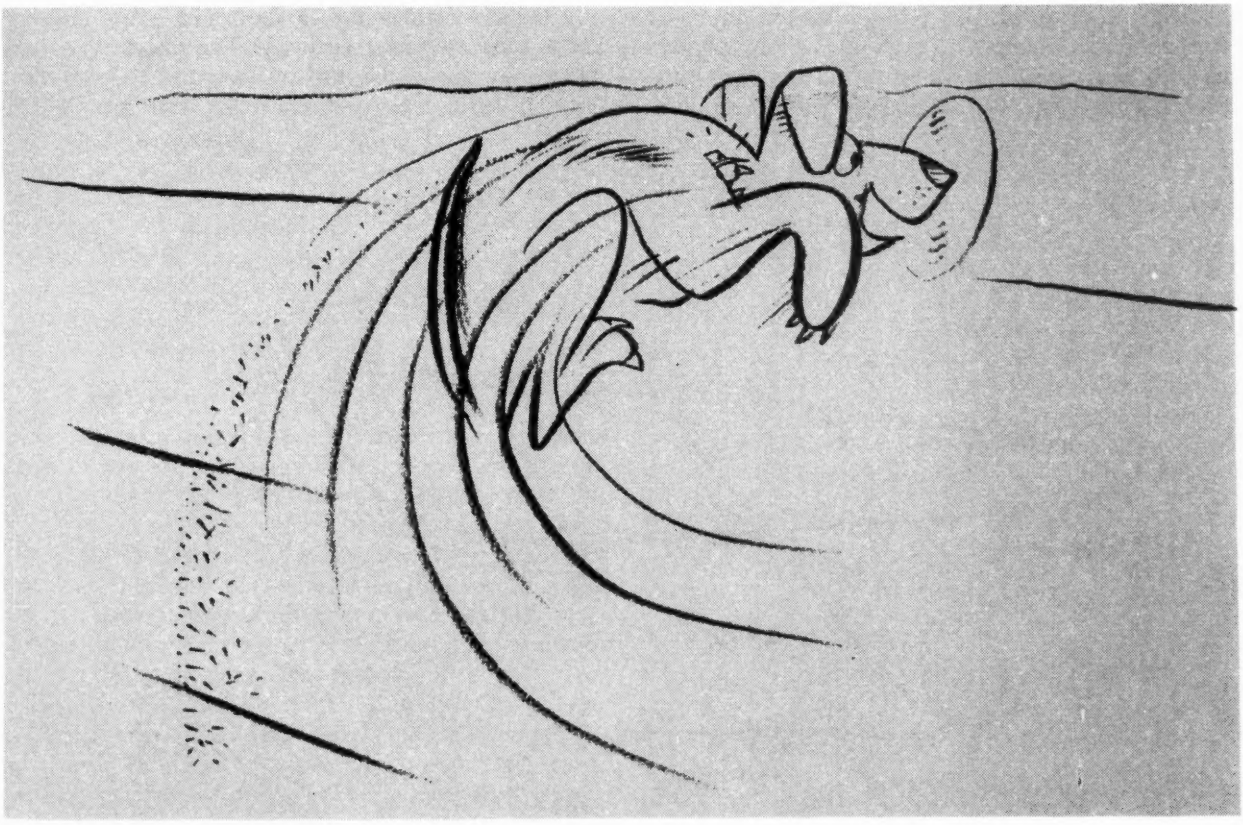
The aviator who has made a bad approach, pretzeled his prop, bounced higher than a tennis ball dropped from the Washington Monument, and now faces the unpleasant vista of a grove of evergreens off the end of the runway is in no position to go around. About the best he can hope for is that pine needles don't taste as bad as he has been led to believe.

Follow Through

The aviator roosting in the pines a couple of hundred feet past the end of the runway may be there because he has goofed his landing in any number of ways. It's a hard and expensive way to learn, but he has had driven forcibly home the fact that a good landing is a start-to-finish proposition that is far from complete at the moment of touchdown. The aircraft is back on the ground at touchdown, to be sure, but as long as anything is moving — blades, wheels, or prop — it can still get in more trouble in a matter of seconds than a small boy loose in a candy store.

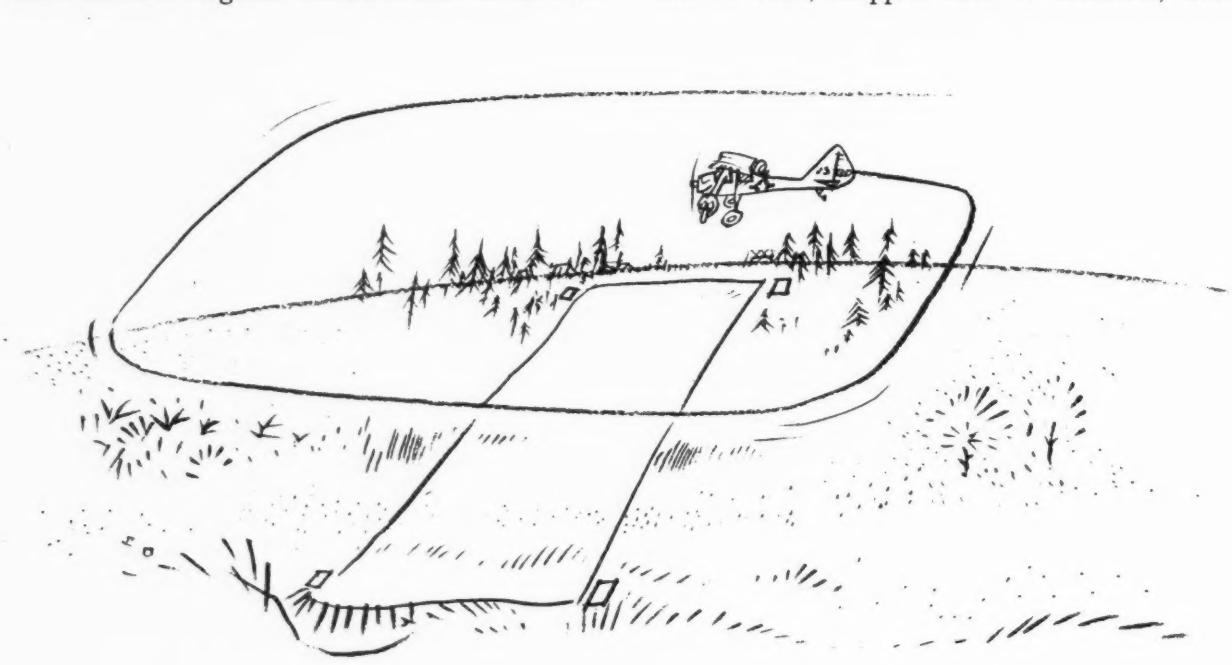
The majority of landing accidents occurs on rollout. Lack of experience? Statistics show older pilots are just as much at fault as those whose hours in the air about equals their bank balance at the end of the annual family vacation. All the experience in the world fails to help if a pilot, old as Methuselah or young as the New Year, relaxes his grip and lets his attention off the leash at the time it is most needed.

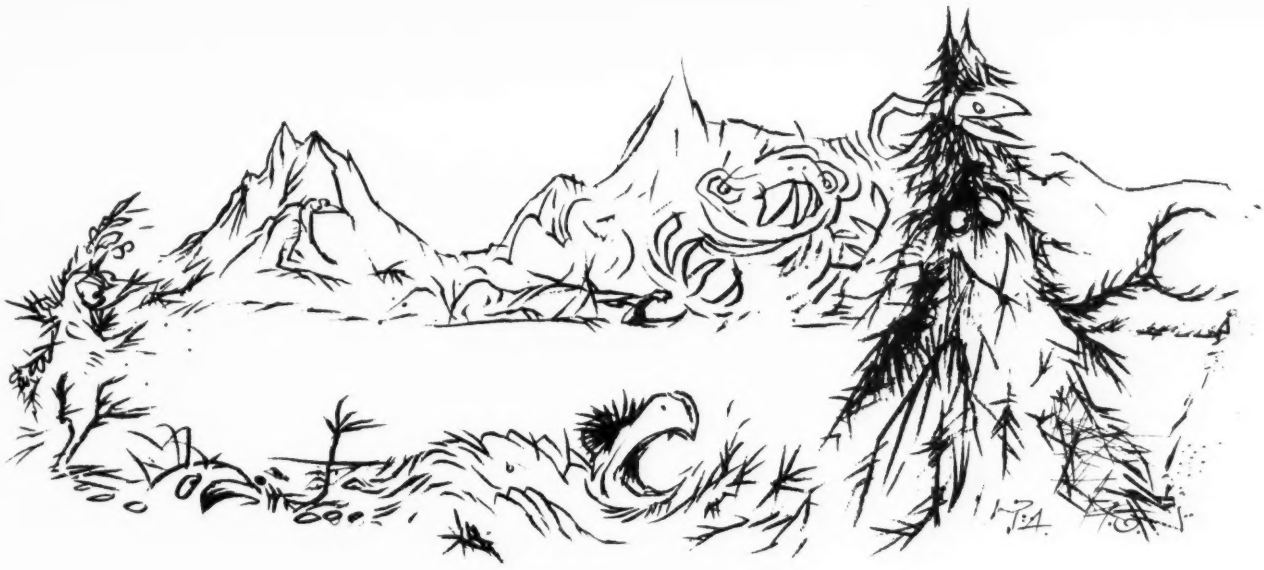
Any aviator can succumb to the natural tendency to let down after a landing. The big word here is *after*. A man coming into the field at the



end of a flight is likely to be slightly less fresh than a day-old egg. He has something to look forward to — the steak he is planning to cook medium rare on the grill in the backyard, a fast round of golf before dark, or a date with the buxom lass he met last week at the club. Musing on such delightful prospects he may "land" his aircraft in the traffic pattern well above the field and make the poor approach which botches his landing. More often, he relaxes at the moment of touchdown, heaves a sigh of relief, wiggles his toes, and winds up standing on his nose in a ditch his Bird Dog has wandered into on its own.

Army fixed wing aircraft demand an aviator's full attention once they are on the ground, the kind of skilled guidance a skittish thoroughbred gets from its jockey once it heads down the home stretch. A plane with a nose wheel tends to follow it obediently down the runway. Left to itself, a Bird Dog and any other nose-wheel-less plane will go off like a beagle sniffing for rabbits. A recent case involved one which set out to investigate something to the right after landing on a hard-surfaced runway. The pilot, who had begun to think about the pleasures the evening had in store, snapped back to attention, added



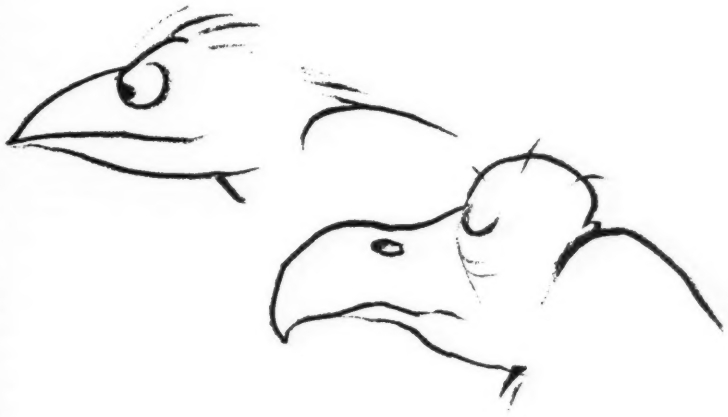


power to regain control, and then reduced it — all in the classic pattern of recognizing a danger the fatal fraction of a second too late. The ground-loop which ended the episode put the Bird Dog on the temporary disabled list with one wing in a splint.

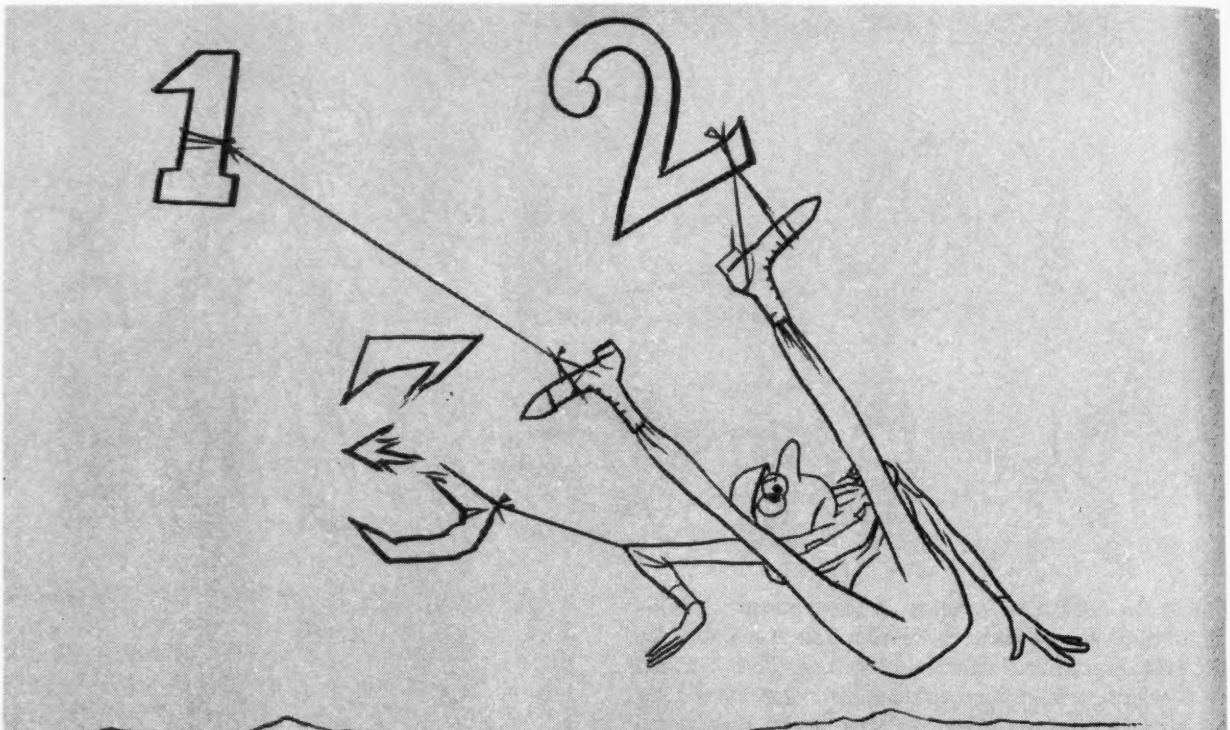
The post-touchdown aspect of landings is not made easier on aviators by the strips the Army is constantly using. They come in more assorted shapes, sizes, and degrees of receptiveness than girls on the beach in July, and are generally more suitable for cows or corn than aircraft. Sometimes the pilot coming in for a landing may enjoy the distinction of being the first human being on the spot since the last Indian tribe moved out. Sometimes, like our friend in the helicopter a while back, he may follow other aircraft which complicate his task by churning up mud or dust. He may be at the controls of an aircraft with different characteristics from the one he has been used to flying.

We all know the value of the reconnaissance, high and low, if we are casing a strip for the first time or reacquainting ourselves with one where some changes may have been made. Telling an aviator about the value of the recon is like advising a jeweler he would do well to lay in a stock of diamonds. But no matter how much he knows about the place he is landing on and no matter how well his approach is executed, any pilot's landing can go sour on him if he fails to follow through with the finesse of a golf pro leading home the field in the National Open.

The tendency of the Bird Dog to wander is only one example of what can go wrong. More often, surface conditions — the mud or dust we've



noted, or wet grass — offer the real problem. Rolling along after touchdown the aviator reverses his prop and suddenly finds himself boring into a cloud he has created which looks like the dust bowl at the height of the drought. Or he hits the slick patch where the grass hasn't dried after the mid-afternoon shower.



No aviator needs go through more than one of these experiences to realize that when he is landing an aircraft he has to ride herd on it from the beginning to end, like a cowpoke chaperoning steers up the Abilene Trail.

You Name It

There is no avoiding the fact that as a start-to-finish proposition more can go wrong with a landing than in any other aspect of flying. The aviator giving solid thought to the procedure can easily reach the depressing conclusion that there are more ways of coming a cropper in landing than there are rice paddies in Vietnam, that they are just about as hard to avoid, and that it is just a question of waiting until his turn comes up to have a landing accident.

The figures would seem to bear this out. Of 410 Army crashes logged in one year, 195 involved landing situations. But take heart! Everybody knows a landing takes more out of a man than straight and level at 5,000 feet on a sunny day in June, and that if aircraft came with little black boxes which took over at landing time the instructors at Rucker could transform raw material into finished aviators before they learned the difference between Enterprise and Atlanta. The cheery thing is that every pilot *does* have sufficient skill and savvy to come down in accepted style under normal and even trying circumstances. Only a fraction of all the Army aircraft landings are eventually filed under the tch, tch, or he-could-have-done-better-category.

But that fraction, let's face it, is avoidable just the same. For all the things which *can* go wrong with a landing, the things which *do* go wrong stem in nearly every case from the fact the aviators involved failed to utilize one simple landing truth:

EVEN A ROUTINE LANDING IS NEVER ROUTINE

To the learner or the man who can still tote up his hours without the aid of a mechanical brain, *no* landing is routine. The older man knows this but he has stuffed the fact away in a cranny of his mind, like a family heirloom lost in the attic. If he manages to sell himself on the idea that any landing can be routine, he is ready to fall victim to a set of attitudes which are about as much a handicap as an anvil tied to a man swimming the English Channel.

1. He fails to plan.
2. He divides his attention improperly.

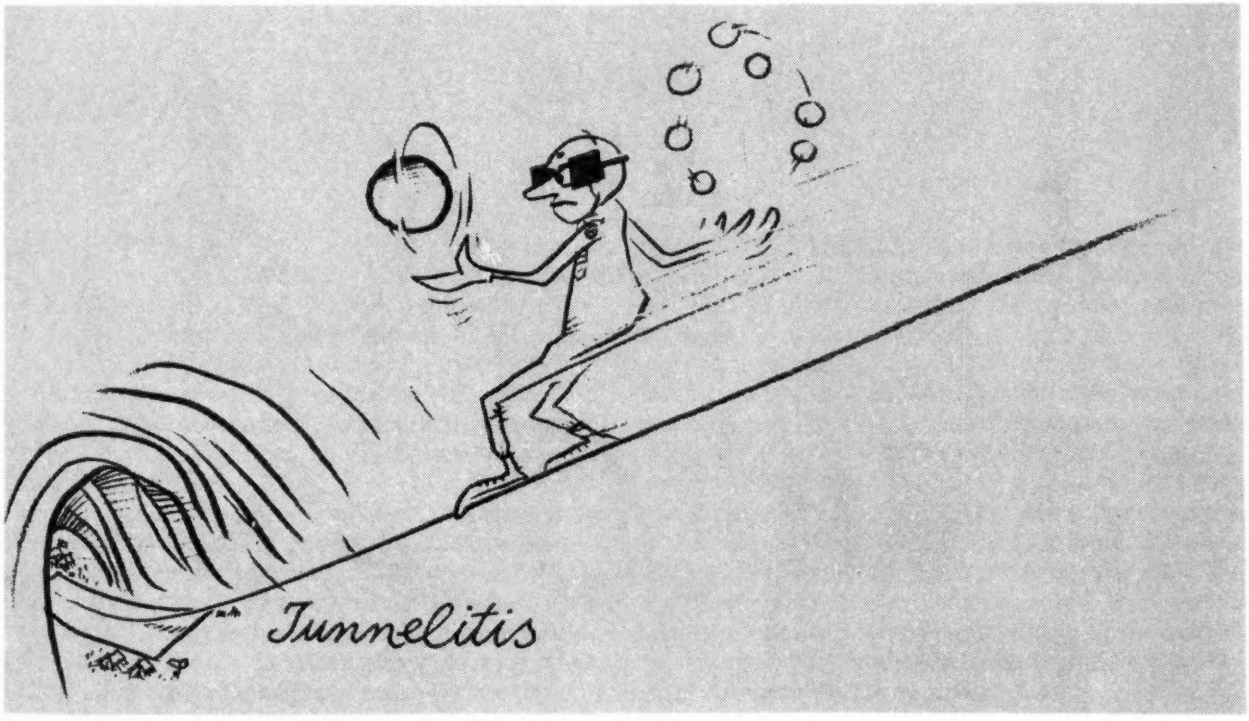
3. He leaves something out.

When he fails to plan, as we've already noted, he is in no position to adjust to an unexpected situation which can interfere with the smooth landing he had in mind. An aviator who does not plan, or plans improperly, has loaded an unnecessary handicap on himself in the execution of a task which is hard enough as it is.

As for the improper division of attention, every pilot knows that the aviator who places too much attention on one aspect of a task is in danger of allowing another factor, equally critical, to creep up on him while his mental back is turned. The more hair-splitting the situation — as in landings — the more careful the pilot has to be to keep his attention in exactly the place it belongs. It's not easy. An aviator coming in, for instance, on a strip lined on either side by parked aircraft can be overwhelmed by the delusion it is considerably narrower than it is and that he is faced with a task about as easy as trying to fly a Bird Dog through a medium-sized culvert on Route 66. Suffering from "tunnelitis," he puts all his attention on trying to thread the needle and loses track of the wind direction, turbulence, line of sights, barriers, drift, attitude, or any one of a dozen or so other things which wind up doing the damage.

The pilot who leaves something out provides another splendid example of how experience is not always the answer by itself. Known in the trade as "telescoping," it is the dangerous custom of finding shortcuts to get a job done in faster and what seems to be smoother style. It is a human trait aviators by no means own the patent on. When a bride bakes her first biscuits after she is back from the honeymoon, she follows the recipe book to the letter. After a while she has enough biscuit know-how to put the book back on the shelf and play it by ear. All is well until she begins taking shortcuts and the day comes when she leaves out the baking powder. Her husband breaks a tooth on a biscuit about as hard as a hockey puck and another promising marriage ends in the divorce courts.

Here is where, as they say, familiarity breeds contempt. To put it another way, the bride — or the older aviator — reaches a point where sloppy procedures have supplanted the way things ought to be done. Once the aviator begins to leave out what he thinks is a minor detail here and there in his landing process to shorten the procedure and make things that much easier all around, he is in a ripe frame of mind inadvertently to omit the *big* detail which *really* counts. One day he tries to land with his wheels tucked up like a hen trying to keep her feet warm in winter.



Down to Earth

Everything about the successful business of getting Army aircraft back to earth adds up to one simple conclusion: it requires a mental attitude and application of skills no different from those involved in any other task in which execution of individual details depends on a sound approach to the overall job.

Football coaches with dreams of the Rose Bowl spend more time on fundamentals than on razzle-dazzle plays. The golfer leading the National Open knows his follow through is essential, but he is also well aware every aspect of his swing must be in the groove and stay there if he wants to keep on belting the ball a mile or so every time he steps on the tee. The Army Aviator lands his aircraft *every* time the way the book prescribes only if he has a mature appreciation of what a *total* landing is and has installed a set of personal fail-safes guaranteed to make each landing a thing of beauty and a joy to behold.

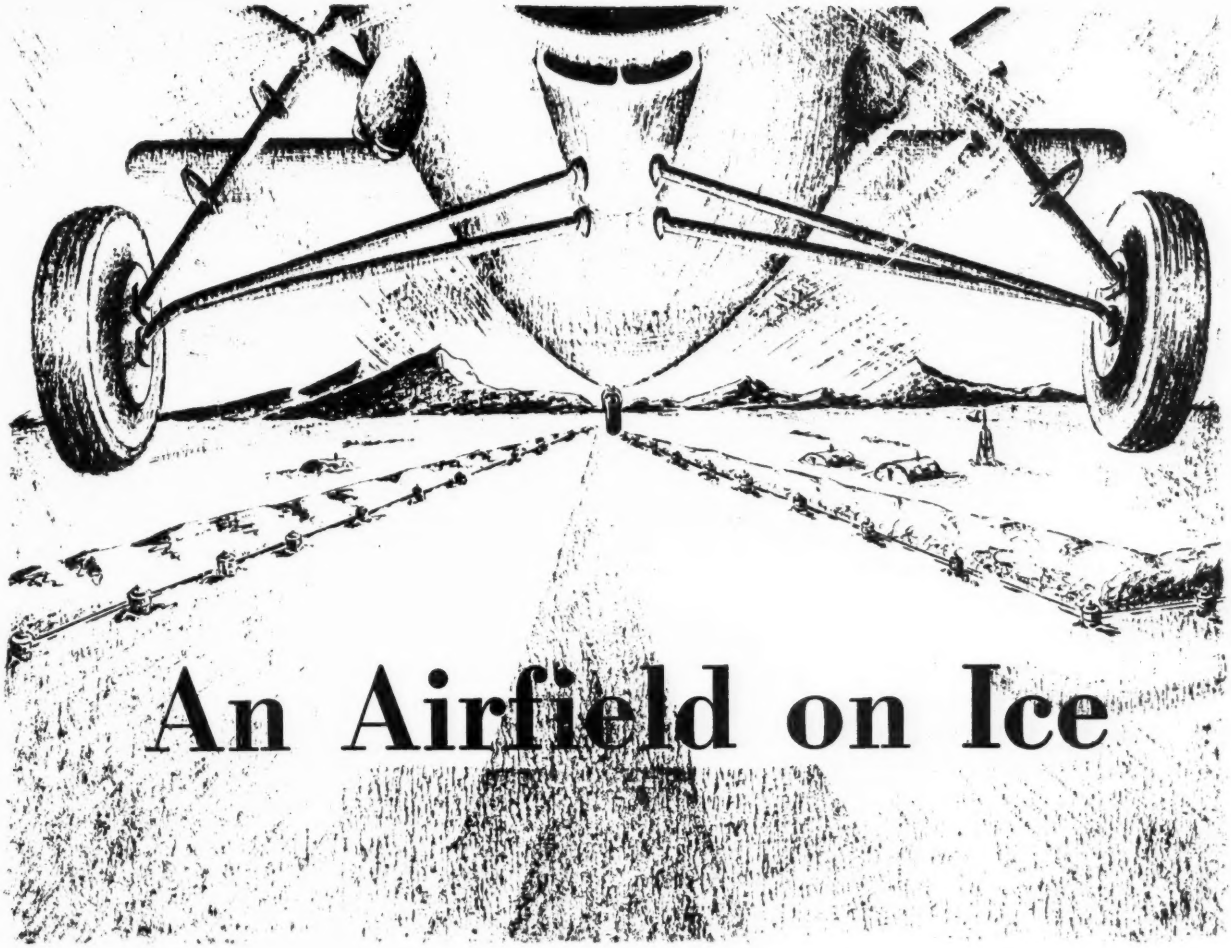
When you get down to it, it is a matter of standard procedures called for in all phases of Army flying. No two aircraft are alike, just as no two aviators are alike. Every pilot knows no two landings will ever be the same, just as the golf pro knows every golf shot is different. But both the pilot and the pro can handle any situation if they follow procedures which have about the same degree of variance as the clock in the Naval Observatory.

The landing-conscious aviator with a set pattern of actions

1. plans,
2. plans to adjust,
3. divides his attention properly,
4. relaxes when the landing is over and his feet are on the ground.

This type of true airman is the kind of peaches-and-cream, smooth-as-silk operator who manages to make every job look as easy as blowing a tin whistle. Watching him bring in a Sioux in a strong gust or a Beaver over a barrier of northern spruce, your dear old Aunt Amanda might get the idea she could do the same thing with no sweat or strain. Old hands on the sidelines know better. Instead they whistle appreciatively at the work of a real professional, the kind who is always destined for

Happy Landings.



An Airfield on Ice

Major J. W. Reser

JUST HOW WOULD you go about building an Army airfield on a hunk of ice? When?

The men of Bryant Army Airfield, Fort Richardson, Alaska, found the answers to these questions in January and February 1960 during Exercise LITTLE BEAR.

Given the word that an airfield was needed to handle Army aircraft, along with Air Force C-47 and C-123 types, planning was started to find the best location, keeping in mind the time element and cost of construction.

The mission of Bryant Army Airfield was to establish and operate the Exercise LITTLE BEAR maneuver director airfield in the Tolsona Lake area and continue operations at Fort Richardson, with no increase in personnel.

The TD of 2 officers and 13 enlisted personnel did not suffer for a lack of specific duties. These were spelled out and included, among normal duties, the provision of flight information and planning data to all pilots; the necessary personnel and equipment to operate the tower and operations center at Tolsona Lake Airfield and Bryant Field; POL support for aircraft at Bryant, Tolsona Lake, and Nicolai Lake airfields; crash and rescue capabilities; and hourly weather service.

An airfield detachment of one officer and three EM departed Fort Richardson in early January 1960 to assist the 56th Engineer Company (Const) in the layout and design of the maneuver headquarters airfield on Tolsona Lake.

Initial testing for ice depth was started the next day. Repeated testings revealed that the layers of ice were separated by water, the first layer being 4-6 inches thick over 3 to 8 inches of water, which, in turn, covered another layer of ice 9-11 inches thick.

The objective was to locate a sizeable area with a constant ice thickness of 17-18 inches, this depth being necessary to support construction equipment.

4,500-FOOT STRIP CLEARED

On January 14th an area 17 inches thick was found near the center of the lake. This depth permitted the grader to operate safely. The snow was then quickly cleared along a strip 200 feet wide by 2,600 feet long. After two days the ice thickness had increased to 24-31 inches. Grader work continued until the length of the strip reached 4,500 feet.

The presence of running streams under the ice caused daily depth variations of up to 8 inches. This meant that ice depth testing was an everyday task.

There is no such thing as the status quo in the Arctic. Cracks in the ice were frequent, varying from 1/16 of an inch to 1½ inches in width up to 1,600 feet in length. Although overflow from the cracks was negligible and did not constitute a problem, the Engineers were required to mend the cracks once during the maneuver. Mending was accomplished by pouring water and slush into the cracks.

Deflection was a word used daily. A transit was used after heavy aircraft landings to determine the ice deflection. The ice deflected some 3 to 5 inches after use by C-47 aircraft; however, no cracks resulted.

Here's a new one to add to your jargon: ice fatigue. Yes, there is such a thing. Takeoffs and landings were rotated from end to end and different touchdown points were designated to prevent ice fatigue.

OPERATIONAL PROBLEMS

Operations on ice create new problems. Traffic control is a major problem with blowing snow from the rotor blades of helicopters drastically limiting the vision of pilots. Ice runways, unless properly marked, also have a tendency to reduce depth perception of pilots when landing. Ski landings on the ice runways were avoided, since braking action was lost and control most difficult. Taxiing can be touchy, in that improperly marked taxiways and snowbanks are look-alikes.

SOME LESSONS LEARNED

As would you, we learned some lessons during LITTLE BEAR. For example, upon completion of the airfield about 1/2 to 1 inch of compacted snow was atop the ice. We found that this compacted snow contributed to good braking action and took steps to maintain at least 1/2 inch of compacted snow on the runway at all times.

Dye marker provided an excellent centerline for the runway and for marking taxiways. Boards 1" x 6" painted orange were found to be very satisfactory for the marking of boundaries of taxiways and snowbanks. The back side of each board was cut to one-half thickness to allow quick breakage in the event the board was struck by an aircraft.

For night operations, half barrels were used with flare pots on top. Used in this manner the flare pots did not melt the ice, and the barrels served as good runway markers during daylight operations.

We found that one officer and seven EM were required to operate the maneuver airfield on a 24-hour basis. The seven included four tower operators, an operations sergeant, a utility worker, and an aircraft serviceman. Their performance was vitally important. The utility worker? He serviced and maintained on a 24-hour basis two large generators and the airfield lighting system.

We feel that ice strips large enough to accommodate any Army aircraft can be built in approximately 24 hours, provided that Engineer support is available and the weather conditions are favorable.

Paperwork? No escaping it, but here it is most useful. We maintained daily takeoff and landing logs by type of aircraft, to include runway used, ice depth, and braking action. Deflections of the ice after each landing by a large aircraft were also logged.

Lastly, we found that the buddy system is a must in this type of operation. In -54° temperatures, personnel must work in pairs and take 10-15 minute timeouts to check others for frostbite. The operations at our ice strip provided excellent experience for all concerned. There may come a day when you'll be downwind to an ice alley. If so, we hope that you are convinced that such operations can be undertaken in an atmosphere of planned safety.

Maj Reser is serving in the Republic of Vietnam.

And the Bird Dog Limped Home

Lieutenant James W. Case

DURING MY SHORT career as an Army Aviator, I had often wondered what it would be like to land an aircraft in a real emergency situation. I had read many stories, listened to the old timers in the coffee shop, and at times even visualized in the true "Walter Mitty" spirit bellying in with one in flames, or something equally as dramatic.

In reality it was not so dramatic. At the time of this accident I had been an O-1 instructor in the road and strip phase of training for about 6 months. The student in the front seat had busted his final checkride the day before, and I was to give him additional dual instruction.

At the first strip his approach was flat with a high pitch attitude. As he cleared the contour at the end of the strip, he made a large throttle reduction. My hand was on the throttle and I immediately opened it to full, but we hit the ground anyway. The bounce was not very hard — I had ridden through many harder — but as the throttle began to take and we began to climb, I felt a heavy thump under my feet. I was continuing the climb when the student announced, "The left gear is missing."

I leaned my head out the window, and all I could see was the brake line hanging where the gear used to be. I pulled my head back inside, and as ridiculous as it may seem I took another look — just to make sure it was gone, I guess. For a moment I thought of going back into the strip, but it was only 800 feet by 75 feet. I knew I was going to groundloop somewhere and decided that was not the place. We turned the Bird Dog and limped toward home.

At 3,000 feet I leveled off and everything now seemed very smooth and comfortable, and I had calmed down quite a bit. With this false feeling of security it seemed a little ridiculous to call Mayday, so I simply gave the tower my number and position and told them my left main gear was missing. A WAC trainee in the tower asked me to repeat it twice and was noticeably shaken as someone else took the mike.

I asked that the operations officer be notified and said that I was open for suggestions as to how to land. As I arrived over the field, the operations officer advised me that Center Safety had been notified and to stand by for a reply. In about three trips around the field, Safety's message came, suggesting a dead stick landing on the sod between the parallel runways, landing on the first attempt, and touchdown as slow as possible.

Everything seemed like a reasonable suggestion except the request that I land on my first attempt. At the time I didn't understand the reasoning behind this, and I wasn't so sure of my power-off accuracy to just pull the mixture and go. I set up the approach for a familiar 180° side and closed the throttle keeping in close to the field. Full flaps were down just before completing the turn to final. When I rolled out I could see I had it made. I told the student to cut the mixture, that there wouldn't be a second try.

From here on I can't remember doing anything different from what you would on any power-off landing. Luckily the touchdown was very smooth, "two point," and I just kept feeding in the right aileron until the speed was gone and the aircraft came down on the belly and left wingtip. Just enough forward speed was left that the aircraft made a very slow 180° skid to the left. Unbelievably, the only damage to the aircraft on the landing was the prop and the navigation light on the wingtip. The wing itself was not damaged.

I believe three things are to be learned from this experience:

- First, if you get in trouble up there, let someone on the ground with a cleared, calmer head appraise the situation if time permits.
- Second, when the landing gear breaks out of an O-1, it is possible for the strut or at least the connection for the strut to go with it, leaving only a couple of bolts holding on the wing. In this case ignorance may have saved some additional damage, for this fact did not occur to me until I was on the ground. If it had, I would possibly have landed back on the strip. It was later proved that the gear broke due to materiel failure and thus came out clean with no damage to the gear box. This of course was not known by Safety and was why they suggested an immediate landing.
- Finally and most important, never let a student get ahead of you even for a fraction of a second. This is a lesson I haven't forgotten.

Lt Case is an instructor, Advanced Flight Division, Dept of Advanced Fixed Wing, USAAVNS, Ft Rucker, Ala.

. . . to fly again

MEMBERS OF THE Italian and American armies joined forces recently to retrieve an Italian helicopter downed in an isolated area about 10 miles north of La Spezio.

An Italian pilot, stationed at the Italian Army's Tactical Aviation Training Center in Viterbo, experienced engine failure on his Model 204 helicopter, an aircraft similar to the U. S. Army's UH-1B Iroquois. Through skillful autorotation, he was able to maneuver his powerless craft to a landing in a small clearing.

Since the area was inaccessible by road, the only feasible method of recovering the helicopter was by air. A request for help was sent to the U. S. Army's Southern European Task Force (SETAF). The mission was assigned to SETAF's 110th Aviation Company located at Boscomantico airfield in Verona.

After approximately 2 hours flying time a few days later, the recovery CH-34 set down beside the disabled Italian aircraft. Under the supervision of an officer of the 110th the operation was begun, which first required dismantling the downed aircraft to reduce the lift load. This was performed jointly by members of the Italian Army's 2nd Tactical Air Reconnaissance Unit from Bologna and SETAF's 17th Transportation Detachment from Boscomantico.

Three flights were necessary to transport the disassembled aircraft between its downed location and an airfield at Sarzana, almost 14 miles away.

The entire recovery went smoothly and, although considered one of Army's aviation duties, the task is never an easy one.